ENVIRONMENTAL MONITORING RESULTS OF THE MEXICAN FRUIT FLY ERADICATION PROGRAM, SAN DIEGO COUNTY, SPRING 1990

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Environmental Hazards Assessment Program

STATE OF CALIFORNIA
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Division of Pest Management, Environmental Protection and Worker Safety
Environmental Monitoring and Pest Management Branch
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DEPARTMENT OF FOOD AND AGRICULTURE

EXECUTIVE SUMMARY
Of Report EH 91-4 Entitled
"Environmental Monitoring Results of the Mexican Fruit Fly Eradication Program, San Diego County, Spring 1990"

Environmental Monitoring and Pest Management Branch
Division of Pest Management, Environmental Protection and Worker Safety
Department of Food and Agriculture

PURPOSE:

Staff of the California Department of Food and Agriculture (CDFA) measured the amount of malathion and malaoxon (a breakdown product of malathion) on the ground, in water and in air resulting from a malathion bait mixture applied by air to eradicate the Mexican fruit fly in San Diego County.

BACKGROUND:

Mexican fruit fly, an insect native to central Mexico, attacks over 50 types of tropical fruits in Mexico, Central and South America and poses a serious threat to California citrus and fruit trees. The CDFA identified two previous infestations of Mexican fruit flies and eradicated them: in San Diego County in 1954, and in Los Angeles County in 1983-84. The current infestation was discovered in central El Cajon (San Diego County) and in Compton (Los Angeles County) during April of 1990. To eradicate the flies in this infestation, CDFA used three aerial applications of malathion bait, followed by releases of 182 million sterile flies.

STUDY METHODS:

The Environmental Hazards Assessment Program (EHAP) of CDFA monitored three aerial applications of malathion bait, which occurred on May 21, June 4, and June 18, 1990, in the 16-square-mile treatment area in El Cajon, San Diego County. EHAP scientists measured the amount of malathion and malaoxon reaching the ground (also known as mass deposition), the size and number of droplets reaching the ground, concentrations of malathion and malaoxon in water bodies, and indoor and outdoor air concentrations of malathion and malaoxon.

Inside the treated area, staff scientists collected mass deposition and droplet size samples during all three applications at 21 sites: three schools, a hospital, and 17 private residences. In addition, water concentrations from a private swimming pool and a private two-and-one-half acre pond used for fishing and boating were measured before and immediately after applications. Staff also took air samples before, during and up to 48 hours after the applications at four sites: three schools and a hospital.

Outside the treated area, EHAP scientists collected water samples from two surface water runoff channels. In consultation with the U.S. Fish and Wildlife Service and the California Department of Fish and Game, EHAP monitored a potential endangered species habitat for mass deposition and droplet size.

RESULTS:

A. **Mass** Deposition

Malathion and malaoxon mass deposition was combined and expressed as malathion equivalents. This combined mass deposition averaged 1,904 micrograms per square foot. The expected application rate was 2,212 micrograms per square foot.

B. Droplet Size

Applications contained an average of 929 droplets per square foot from 63 samples. The average diameter was 259 micrometers.

C. Water

Samples collected from the private recreational pond and swimming pool before the applications showed no detectable levels of malathion or malaoxon. Malathion concentrations measured immediately after the applications ranged from 1.2 to 57 parts per billion in the pond, and from none detected to 27 parts per billion in the pool. These concentrations are well below the California Department of Health Services Action Level of 160 parts per billion malathion. However, the acute (24-hour exposure) water quality criterion of 3.54 parts per billion malathion for fresh water (recommended by the California Department of Fish and Game for identifying potential fish kill situations) was exceeded in the pond. Mortality of recently stocked fish fry was reported during the first application. However, there was not enough tissue to analyze to determine if malathion was present in the fish. This pond was flagged for exclusion from spraying for the second and third aerial applications, and no further fish kills occurred. No malaoxon was detected in the pond, and it ranged from 1 to 14 parts per billion in the pool.

D. Air

EHAP scientists measured concentrations of malathion and malaoxon in air from 186 samples collected at four sites. In almost all cases, levels of malathion detected were greater than those of malaoxon. The highest concentrations detected were 36 parts per trillion malathion and 21 parts per trillion malaoxon which were measured indoors during and after an application, respectively. The work place standard for daily employee exposure to air concentrations of malathion is 745,000 parts per trillion.

E. Outside the Treated Area

Water samples, collected from two surface water runoff channels within a mile downstream of the treated area, showed measurable amounts of malathion and malaoxon within 24 hours after rainfall. The highest malathion concentration measured was 80 parts per billion. It was found five days after an application after rainfall.

In agreement with the U.S. Fish and Wildlife Service and the California Department of Fish and Game, scientists collected mass deposition samples during all applications from a riparian site located within one-quarter mile of the treated area, believed to be a potential habitat of an endangered species of bird called Least Bell's Vireo. During the first and last applications, respectively, 17 and 24 micrograms per square foot of malathion were found deposited due to movement of the pesticide from the treated area or to contamination during sample collection. No detectable levels of malathion were found during the second application.

F. CONCLUSIONS:

Environmental monitoring results from malathion bait treatment for eradication of the Mexican fruit fly in El Cajon are similar to those from the Mediterranean fruit fly (Medfly) treatment program in Los Angeles County that was conducted earlier in the year.

Malathion mass deposition for this program was not significantly different from deposition results during the 1990 Medfly program.

Droplet sizes measured during these applications were slightly smaller than those calculated for the Medfly eradication program. Local topography necessitated variable flight elevations for the aerial applications which may have affected droplet size during deposition.

Surface water concentrations of malathion and malaoxon were within the range of previous eradication program monitoring results. The presence of malathion in runoff water immediately after rainfall events indicated that malathion can be expected to move out of the treated area for an unknown period of time after an application, if rainfall occurs.

Average malathion and malaoxon air concentrations were greater than those measured during Medfly eradication program monitoring. However, due to the small number of samples collected during this

Mexican fruit fly eradication program, it was not possible to test for statistical differences between these two programs.

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3/6/91

ENVIRONMENTAL MONITORING RESULTS OF THE **MEXICAN** FRUIT FLY ERADICATION PROGRAM, SAN DIEGO COUNTY, SPRING **1990**

BY

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ENVIRONMENTAL HAZARDS ASSESSMENT PROGRAM

ABSTRACT

The California Department of Food and Agriculture Environmental Hazards Assessment Program monitored three aerial applications of malathion during the Mexican fruit fly eradication program in El Cajon, San Diego County. Mass deposition, droplet size distribution of malathion, and concentrations of malathion and malaoxon in water and air were measured. Results were compared to 1990 Mediterranean fruit fly monitoring results.

The mass deposition rate of malathion was similar to that found during the 1990 Mediterranean fruit fly monitoring and averaged 1904 µg ft^{-2} or 86 percent of the targeted application rate of 2212 µg ft^{-2}. Droplet size calculations indicated a mean droplet size of 256 µm for 63 sites compared to the mean droplet size of 308 pm observed during the 1990 Mediterranean fruit fly monitoring.

Pond and pool water concentrations of malathion ranged from none detected to 57 ppb. Samples collected immediately after each application showed that malathion was oxidized rapidly to malaoxon in pool water but not in pond water. Surface runoff samples provided evidence that malathion was moving out of the treatment area after rainfall events. The highest concentration found was 80 ppb, collected from rainfall runoff a mile northwest of the treatment area five days after the second application.

Indoor and outdoor air samples were collected before, during and after each application. Average malathion concentrations were generally higher than malaoxon concentrations with outdoor concentrations of malathion higher than those found indoors. Peak concentrations of malathion and malaoxon were 0.48

$\mu g\ m^{-3}$ (36 ppt) and 0.27 $\mu g\ m^{-3}$ (21 ppt), respectively. Ambient air concentrations appeared to be slightly higher compared to the 1990 Mediterranean fruit fly air concentrations, but due to the small number of samples collected during Mexican fruit fly eradication program, it was not possible to test for statistical differences between the two programs.

ACKNOWLEDGEMENTS

We would like to express our thanks to Bill Routhier's crew in San Diego for their assistance in selecting monitoring sites and for providing background information on the project. Our appreciation also goes to the residents of El Cajon who allowed us to use their properties as monitoring sites. Finally, we want to say thanks for the help received from the Pest Detection and Emergency Projects Sacramento staff and for the monitoring done by the EHAP field crew.

DISCLAIMER

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INTRODUCTION

Mexican fruit fly (<u>Anastrepha ludens</u>), an insect native to central Mexico, has expanded its range considerably as a result of agricultural practices of the past century. It attacks over 50 types of tropical fruits in Mexico, Central and South America, and poses. a serious threat to California's citrus, pome and stone fruit crops (Murphy and Coronado, 1986). The California Department of Food and Agriculture (CDFA) has twice identified Mexican fruit fly infestations as the fly migrated northward into California, Successful treatment of the first infestation in San Diego County in 1954 was achieved by malathion ground applications. In 1984, CDFA eradicated the fly in Los Angeles County using aerial applications of malathion. The current infestation was discovered in central El Cajon, San Diego County, and in Compton, Los Angeles County during April, 1990. Three aerial applications of malathion followed by the release of millions of sterile adult Mexican fruit flies were selected as the most efficient means of eradication with minimal health and environmental effects (Dowell, 1990).

<u>Aerial Treatment Program</u>

Malathion under the label name of Clean Crop Malathion ULV (Platte Chemical Company) was combined with a plant-based insect bait called Nu-Lure. The treatment area was 41.4 hectares (ha) over which 3,430 liters of the mixture were sprayed per application (Figure 1). Malathion, 21.1 percent by weight of the mixture, was applied at a rate of 238 g ha^{-1} (2212 $\mu g\ ft^{-2}$). For each application, six Bell 204 helicopters equipped with booms and Tee Jet 8010 flat fan spray nozzles discharged the mixture over a nominal swath width of 61 m. The helicopters flew at a minimum elevation of 91 m above ground level which varied considerably due to local topography. Operations took place at night,

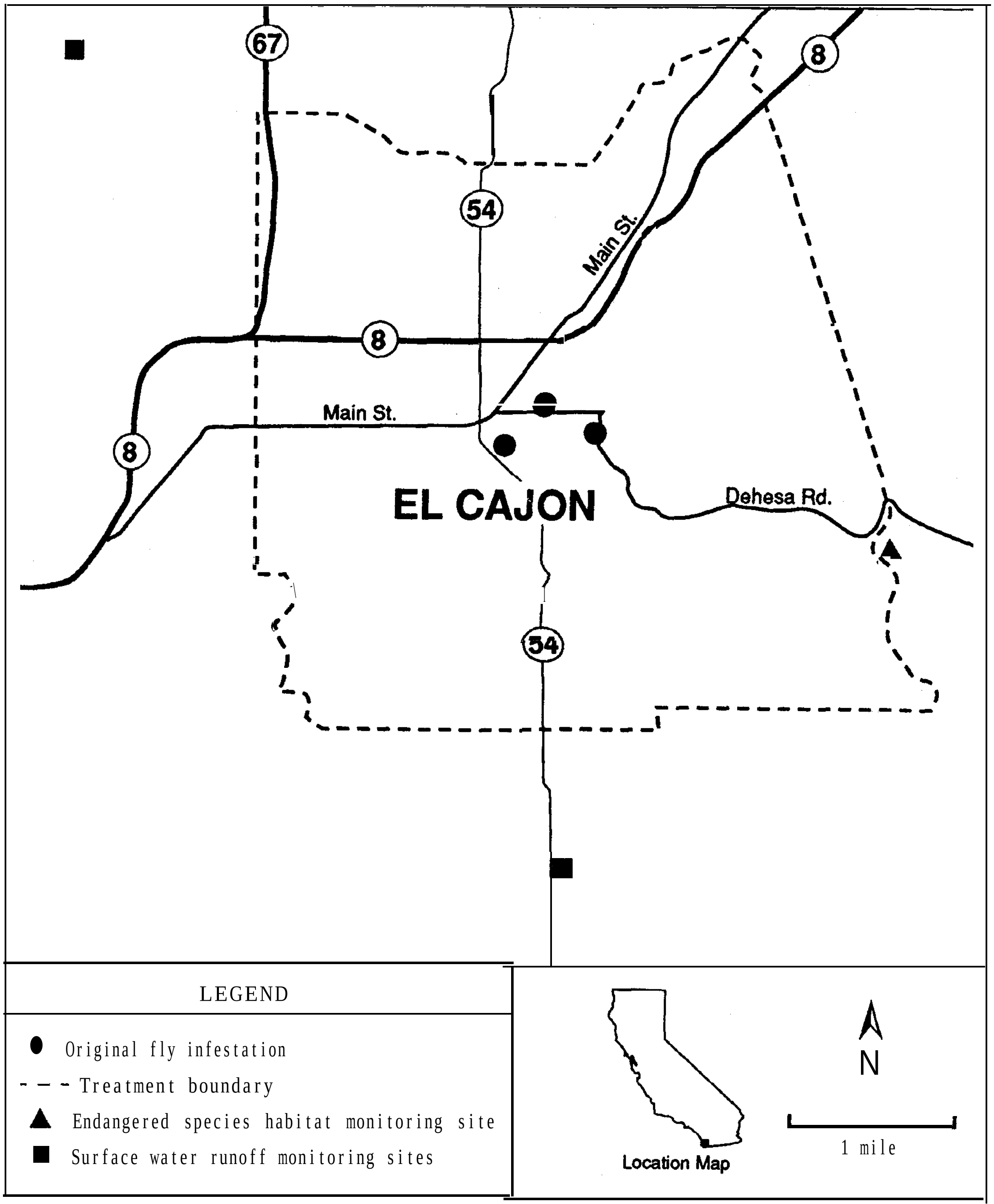


Figure 1. Map of Mexican fruit fly aerial treatment site in San Diego County, California, Spring 1990.

normally finishing before midnight. The treatment program consisted of three applications of malathion and bait two weeks apart on May 21, June 4 and June 18, 1990. The applications were followed by sterile fly releases. Eradication was declared on October 18, 1990, four months after the last application,

Environmental Monitoring Program

The CDFA Environmental Hazards Assessment Program (EHAP) monitored the treatment program to characterize malathion droplet size, mass deposition, and concentrations in air and water inside the treatment area. Sensitive areas outside the treatment area were also monitored for potential movement of the pesticide during or after application.

The EHAP recently completed environmental monitoring during the Mediterranean fruit fly eradication program in Los Angeles and Orange Counties. The materials and methods used for that program were similarly implemented for the Mexican fruit fly eradication program. A summary of materials and methods is presented in this report and readers who would like additional information may refer to Segawa et al. (1990).

MATERIALS AND METHODS

Monitoring Sites

Seventeen residences were selected within the treatment area for mass deposition and droplet size distribution sampling (Table 1). A swimming pool and 2-hectare pond, located at separate residences, were used to monitor malathion

Table 1. Number and type of environmental monitoring sites inside treatment boundaries for the Mexican fruit fly eradication program.

	Site Number			
Application Date	Mass Deposition	Droplet Size	Water	Air
May 21, 1990	17 Residences 3 Schools 1 Hospital	17 Residences 3 Schools 1 Hospital	1 Pool 1 Pond	3 Schools 1 Hospital
June 4, 1990	17 Residences 3 Schools 1 Hospital	16 Residences 3 Schools 1 Hospital	1 Pool 1 Pond	3 Schools 1 Hospital
June 18, 1990	18 Residences 3 Schools 1 Hospital	18 Residences 3 Schools 1 Hospital	1 Pool 1 Pond	3 Schools 1 Hospital

concentrations in confined surface water. Three public schools and one hospital were chosen as sites for air monitoring in addition to mass deposition and droplet size monitoring.

Two runoff locations were monitored for malathion movement offsite in surface waters during the aerial applications and after rainfall events (Figure 1). The northwest channel was fed by irrigation and storm runoff from the central treatment area and drained into the San Diego River. The southern channel also drained the treatment area and fed into the mostly dry Sweetwater River bed. In addition, the potential habitat of an endangered species just outside the southeastern boundary of the treatment area was monitored for malathion deposition during applications.

Mass Deposition

Mass deposition cards ($930\ cm^2$ each) were placed at all sites several hours before aerial application began. Cards consisted of absorbent paper towels with plastic backing attached to plastic-covered cardboard. They were placed on sampling platforms at ground level or up to 1.5 m above the ground depending upon individual site characteristics. From 15 minutes to one-half hour after application the cards were collected, wrapped in aluminum foil, and frozen until analysis was performed.

The CDFA Chemistry Laboratory Services analyzed mass deposition samples by first extracting residues from the towels with ethyl acetate. Extract aliquots were diluted and analyzed for malathion by gas chromatograph (CC) with a thermionic specific detector (TSD). Remaining extracts were concentrated and analyzed for malaoxon using a CC with a flame photometric detector (FPD).

Results were reported in micrograms (µg) per sample which equaled µg ft^{-2}. The minimum detection limit was 1.0 µg ft^{-2}. Complete analytical methods are given in Appendix A.

Droplet Size

Droplet size was measured using fallout cards. Each droplet card consisted of Kromekote® cover 65 lb glossy paper (approximately 115 cm^2) set within a cardboard holder which was then attached to a sampling platform next to the mass deposition sample. After application, the cardboard holder was folded to enclose the droplet card to prevent sample damage. The samples were stored at room temperature until they were examined by microscope. The total area examined per card was 38 cm^2 using randomly selected cross-sections. Droplet stains were divided into one of 12 size categories with the help of a graticule (sizing grid). The observed droplet diameter was corrected for impact enlargement using a spread factor described by the following equation (Segawa et al. 1990, Appendix A):

true diameter (urn) = 12.4055 + 0.58462(observed diameter)
- (1.7558 x 10^{-5})(observed diameter)*

The percentage of drops in each size range and droplet density (number per ft^2) was determined by the number of droplets in each size category. The mean droplet diameter was calculated by multiplying the arithmetic mean of each size category by the proportion of droplets in the category and summing the values across all categories. Droplet size distributions were graphed by plotting the arithmetic mean of each size category versus the percentage of droplets in each category. Each category was divided by its range to adjust for unequal size.

Water

One swimming pool at an apartment complex and one 2-hectare pond at a private residence were monitored for malathion concentrations before and after each aerial application. Two samples were collected per event at each site. Background samples were collected several hours before spraying and post-spray samples were collected within 30 to 45 minutes after application. Samples were collected in 1 liter amber glass bottles with teflon®-lined caps. At the swimming pool, samples were collected by submerging each bottle near the edge of the pool, removing the cap, and allowing the bottle to fill completely. At the pond, samples were collected in a similar manner from a floating dock at the pond edge or from the interior of the pond accessed by raft or boat. Water samples were refrigerated until they were extracted with methylene chloride. The extract was filtered, evaporated to dryness, brought up to final volume with acetone, and analyzed for malathion and malaoxon using a CC with FPD. Results were reported in parts per billion (ppb). The minimum detection level was 0.1 µg per liter. Complete analytical methods are given in Appendix A.

Air

Three public schools and one hospital were used as air monitoring sites before (24-hr sample), during (up to 3-hr sample), and after (two 24-hr post-spray samples) each malathion application. Indoor and outdoor samples were collected at each site using General Metal Works® high volume air samplers equipped with Kurz® model 310 flow controllers, calibrated at 1000 l min^{-1}. Glass containers holding 125 ml XAD-2® resin trapped the pesticide during the sampling period. After each interval, resin samples were sealed and frozen in plastic bags until they were extracted with acetone, concentrated and analyzed for malathion and malaoxon using a GC with FPD. Analytical results were reported in µg with a minimum detection limit of 0.1 µg. Complete chemical methods are given in Appendix A. The mass of pesticide reported was divided by the total volume of air sampled to yield a calculated concentration in µg m^{-3}. As Segawa et al. explained in their report (1990), the air sampling methods employed produced artificially high malaoxon values. Tests showed up to 65 percent conversion of malathion to malaoxon over a 24-hr period using high volume air samplers. Air concentrations reported here are not corrected for oxidation and consequently the malaoxon values reported are more than likely overestimates of true values while, conversely, malathion concentrations may be underestimated.

Sample Integrity

Each sample was accompanied by a chain-of-custody record from sample collection to analysis. The record contained information necessary to identify the sample and to show its custody. Samples were secured in locked vehicles and freezers during transport and storage. Field personnel changed gloves between samples to prevent cross-contamination during sample collection. Used disposable equipment was sealed in plastic bags and properly disposed of. Reusable equipment was cleaned with soap followed by three separate rinses in water, deionized water, and isopropyl alcohol.

Quality Control Program

Field blanks were submitted for analysis with mass deposition, air, and water samples to determine if sample contamination had occurred during field sampling, shipment or storage. Laboratory blanks were analyzed to determine if sample contamination had occurred while in the laboratory. Laboratory spikes were used to determine the accuracy and precision of the analysis. In the case of water samples, some samples were split and analyzed by two laboratories to measure accuracy.

RESULTS AND DISCUSSION

Mass Deposition

Quality control laboratory spikes for mass deposition samples averaged 97 and 98 percent recovery for malathion and malaoxon, respectively (see Appendix C for complete results). Field and laboratory blanks showed no detectable levels of pesticide. One-half the detection limit was used in calculating means, standard deviations, and statistical tests when samples had no detectable presence of malathion or malaoxon.

Mass deposition of malathion and malaoxon (combined as malathion equivalents) for three applications averaged 1904 $\mu g\ ft^{-2}$ or 86 percent of the targeted application rate of 2212 $\mu g\ ft^{-2}$ (Table 2). Deposition rates varied from 65 to 6848 $\mu g\ ft^{-2}$ for 64 samples.

Results for mass deposition were similar between this eradication program and the 1990 Mediterranean fruit fly eradication program (Figure 2). The distributions of the two programs were not significantly different (chi-square test of independence, $p=0.29$). Average deposition and variability during this eradication effort was greatest for the third application of malathion. The number of mass deposition samples collected during the Mexican fruit fly

Table 2. Mass deposition of malathion and malaoxon for all applications.

	Malathion	Malaoxon	Total (as Malathion)
	---------------- µg ft^{-2}	--------------------	
May 21, 1990:			
Number of Samples	21	21	21
Mean	1908	2.35	1911
Standard Deviation	1094	1.60	1096
Standard Error	239	0.35	239
Minimum	430	ND[a]	430
Maximum	4407	6.70	4414
June 4, 1990:			
Number of Samples	21	21	21
Mean	1760	2.94	1763
Standard Deviation	1257	3.73	1258
Standard Error	274	0.81	275
Minimum	65	ND	65
Maximum	4080	18.25	4099
June 18, 1990:			
Number' of Samples	22	22	22
Mean	2027	4.53	2031
Standard Deviation	1421	2.74	1423
Standard Error	303	0.58	303
Minimum	343	ND	344
Maximum	6841	10.50	6848
Combined Applications:			
Number of Samples	64	64	64
Mean	1900	3.29	1904
Standard Deviation	1252	2.93	1253
Standard Error	156	0.37	157
Minimum	65	ND	65
Maximum	6841	10.50	6848

[a]Not detected. Minimum detection limit was 1.0 ug.

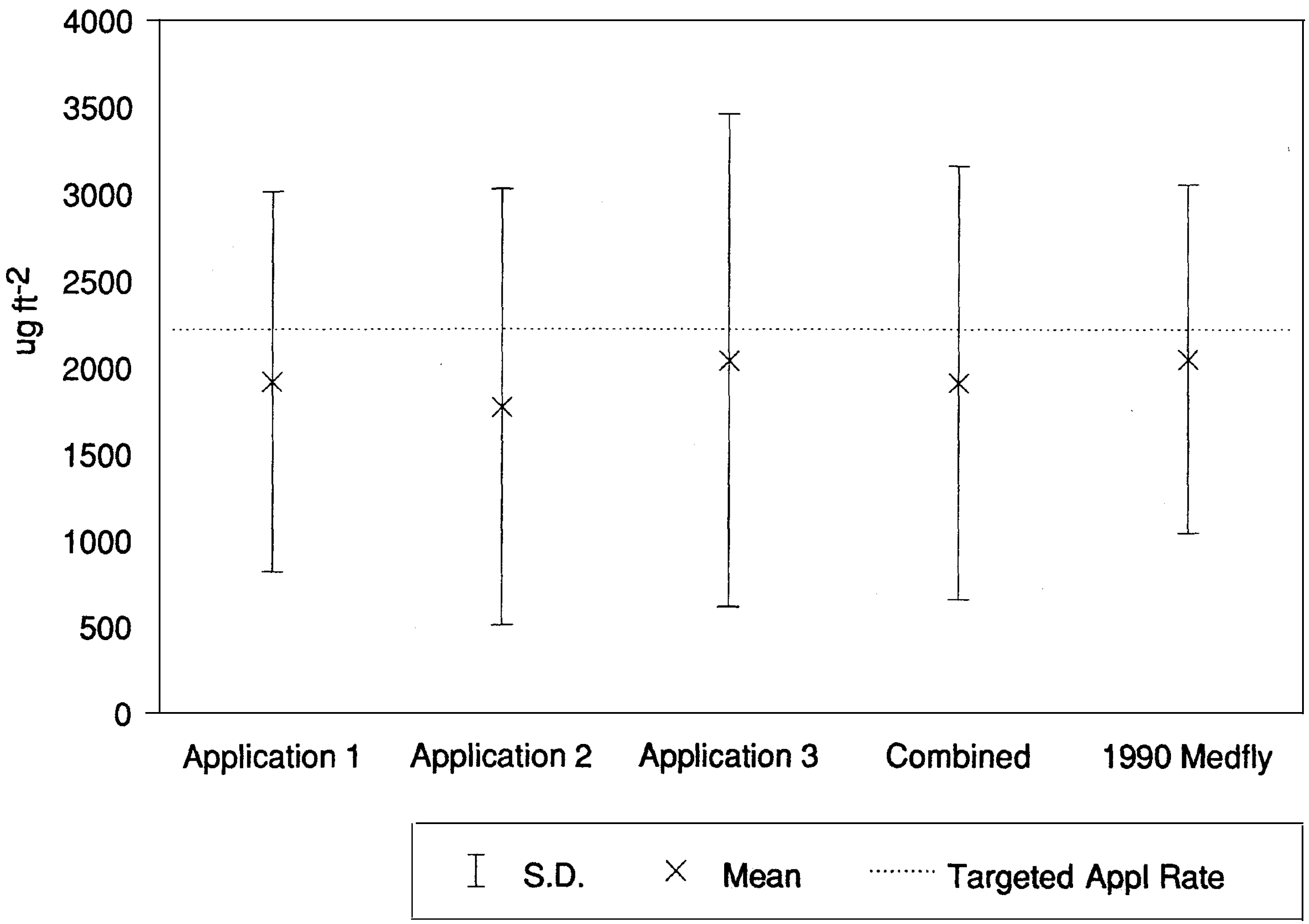


Figure 2. Average mass deposition of malathion and malaoxon during three applications and comparison of combined application deposition with the 1990 Mediterranean fruit fly deposition data.

eradication program in each quintile of the combined distributions for both programs (Figure 3) indicates over 50 percent of these samples contained less than 1685 μg ft^{-2}.

Mass deposition was also monitored at sites which were purposely avoided by the application crew (flagged areas). After being sprayed during the first application, a 2-hectare private pond was flagged for the remaining treatment; subsequent monitoring showed no deposition of malathion during the June 4 application and 503 μg ft^{-2} deposited during the June 18 application.

The potential habitat of an endangered species, Least Bell's Vireo, was monitored during all applications but the former riparian corridor southeast of the treatment area had been extensively developed. The Sweetwater River had been diverted underground and channeled beneath a golf course built on the riparian site. During the first and last applications respectively, 16.97 and 24.02 μg of malathion were found deposited on fallout cards due to out-of-treatment-area drift or contamination during sample collection. There was no detectable malathion found during the second application.

The California Department of Health Services requested an evaluation of the spatial variability of mass deposition within a site. Combined malathion and malaoxon deposition on nine fallout cards at one site during the June 4 application averaged 2310 μg ft^{-2} with a standard deviation of 354 μg ft^{-2}, confirming the expected lower deposition variability within a given site compared to the entire treatment area.

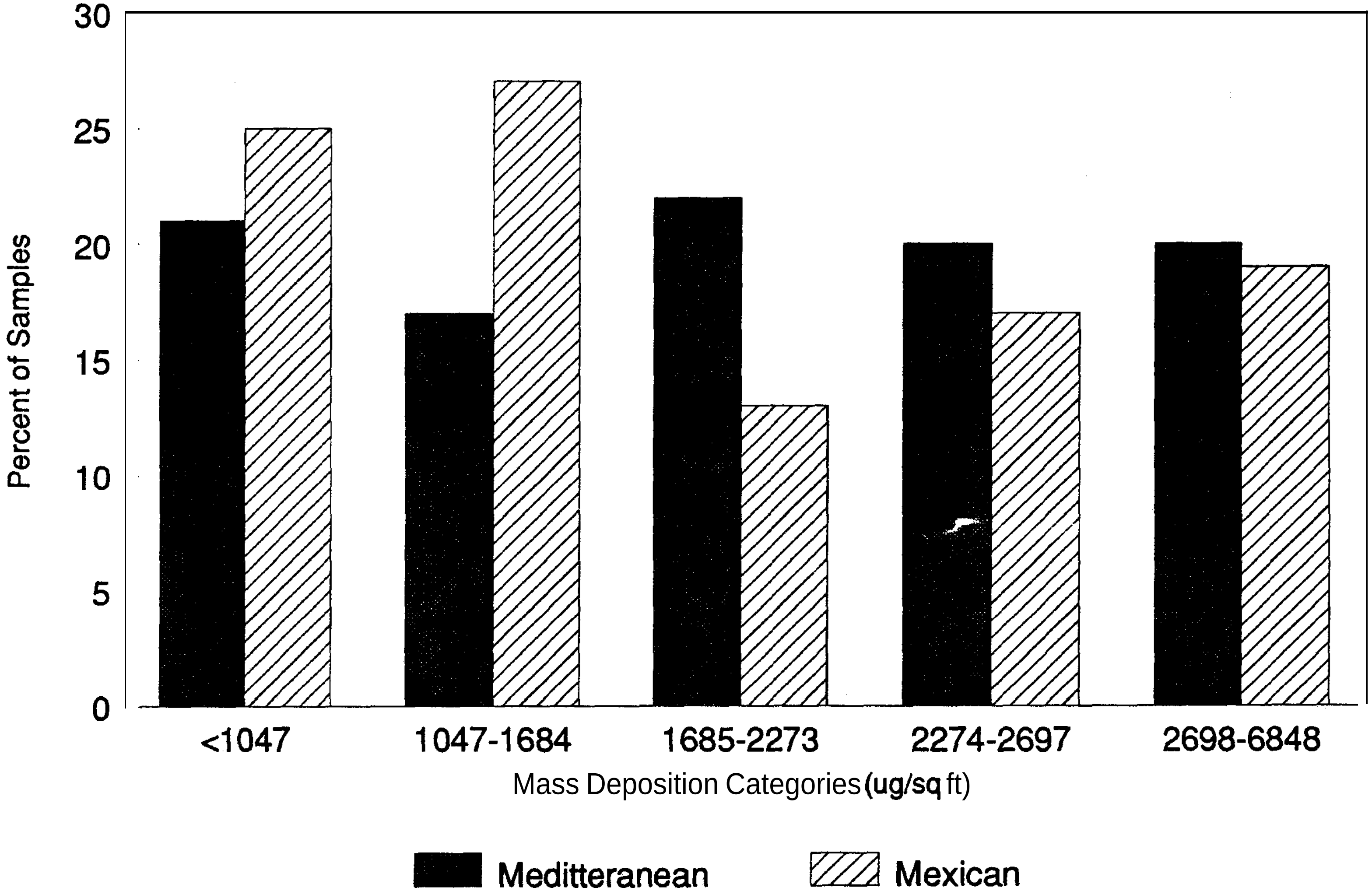


Figure 3. Comparison of 1990 Mexican and Mediterranean fruit fly malathion mass deposition samples within quintiles of their combined distributions.

Droplet Size Distribution

Sixty-three droplet size samples collected during three applications yielded an average of 929 droplets per square foot (Table 3). The average number of droplets measured per card was 38. Results for each application appear in Appendix B. Measured droplet diameters ranged from 46 to 1422 µm with a mean of 259 µm. Fifteen droplets larger than 1422 µm (0.63% of all counted droplets) were observed but not used in calculating the droplet size distribution since they were unmeasurable. Droplets smaller than 46 µm were also unmeasurable. The droplet size distributions of the Mediterranean and Mexican fruit fly applications of 1990 were compared (Figure 4). Though the distributions were similar, the Mediterranean mean droplet size was larger at 308 pm while the Mexican fruit fly distribution had a higher proportion of smaller droplets. No statistical comparison of the two distributions were made since the droplets measured were not independently collected.

No droplets were found on randomly examined areas of cards placed at the endangered species habitat monitoring site during any application. Droplet cards at the flagged pond site recorded 4 and 37 droplets per sample for the second and third application, respectively.

Water

During the analysis of water samples, recovery of malathion and malaoxon in quality control laboratory spikes averaged 87 and 92 percent, respectively. No residues were found in 8 laboratory and 15 field blanks submitted for analysis. Split sample analysis performed by two laboratories showed agreement for 7 out of 9 samples. In two samples, the primary laboratory had

Table 3. Droplet size distribution for all applications.

Diameter Range (μm)	Total Number of Droplets	Droplet Density (No ft^{-2})	Percent Number
46 - 60	1	0.4	0.04
60 -	8	3.1	
80 - 108 80	81	31.4	3.38
108 - 147	563	218.2	23.50
147 - 202	668	258.9	27.88
202 - 279	447	173.3	18.66
279 - 387	312	120.9	13.02
387 - 538	126	48.8	5.26
538 - 747	65	25.2	2.71
747 - 1034	69	26.7	2.88
1034 - 1422	41	15.9	1.71
1422+	15	5.8	0.63
TOTAL[a]	2396	928.6	100.00

[a] 38 cm^{-2} examined on each of 63 droplet cards.

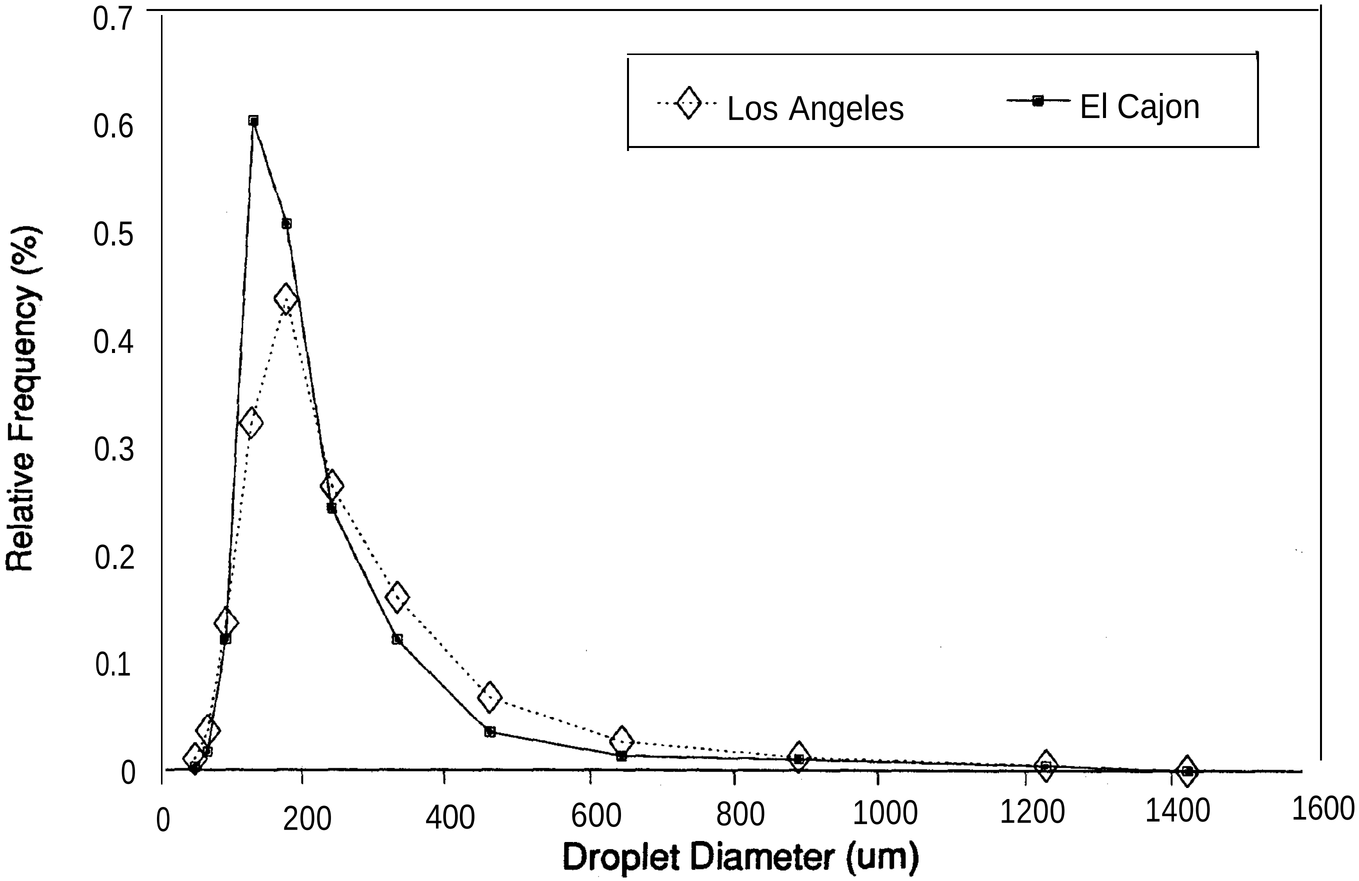


Figure 4. Comparison of droplet size distributions for 1990 Mexican (El Cajon) and Mediterranean (Los Angeles) fruit fly treatment areas.

positive detections while the quality control laboratory had no detections (Appendix C, Table 7).

The highest concentrations of malathion measured were 56.88 parts per billion (ppb) in pond water during the first application, and 28.72 ppb in pool water during the second application (Table 4). Both concentrations were below the highest levels recorded for malathion during the Mediterranean fruit fly monitoring conducted earlier in the year (Segawa et al. 1990). Background samples collected before each application indicated no malathion presence in either pool or pond water before the last two applications. Malaoxon was not found in pond samples and its level in pool samples was within the range expected based on previous monitoring results. The concentrations of malaoxon found in pool samples, from none detected to 14.25 ppb, were most likely due to the oxidizing influence of chlorine. Although the pond site was flagged for the second and third applications, low levels of malathion found in the pond shortly after those applications indicate that the site was not entirely excluded from spraying effects.

Runoff monitoring at two sites within a mile outside the treatment area revealed concentrations of both malathion and malaoxon in unconfined surface water within 24 hours after rainfall (Figure 1). The highest malathion concentration measured, 80 ppb, was found in runoff collected after the occurrence of rainfall 5 days after the second application (Table 5). Collection of samples during dry periods immediately before and after each application generally showed non-detectable levels of malathion and malaoxon.

Table 4. Malathion and malaoxon concentrationsin water at two monitoring sites during three applications.

Location	Application No.	Replicate	Sampling Interval	Malathion (ppb)	Malaoxon (ppb)
Pool	1	1	Background	ND[a]	ND
		2		ND	ND
		1	Spray	ND	14.25
		2		ND	13.65
	2		Background	--[b]	--
		1	Spray	28.72	2.91
		2		0.45	2.17
	3	1	Background	ND	ND
		2[c]			
		1	Spray	ND	7.38
		2		ND	1.18
Pond	1	1	Background	ND	ND
		2		ND	ND
		1	Spray	30.58	ND
		2		56.88	ND
	2	1	Background	ND	ND
		2		ND	ND
		1	Spray	1.20	ND
		2		0.85	ND
	3	1	Background	ND	ND
		2		ND	ND
		1	Spray	2.70	ND
		2		4.52	ND

[a]Not detected. Minimum detection level was 0.1 ppb.

[b]Sample was not collected.

'Sample lost during extraction.

Table 5. Malathion and malaoxon concentrations in surface water runoff channels outside treatment area, May 21-June 19, 1990.

Date	Sampling Interval		Replicate	Malathion (ppb)	Malaoxon (ppb)
Northwest					
May 21	Spray 1	Background	1	ND[a]	ND
			2	ND	ND
May 22		Day 1	1	ND	ND
			2	ND	ND
May 29		Day 8[b]	1	11.95	3.75
			2	15.28	4.94
June 2		Day 12	1	ND	ND
			2	ND	ND
June 5	Spray 2	Day 1	1	ND	ND
			2	ND	ND
June 9		Day 5[b]	1	79.87	16.95
			2	80.07	14.09
June 16		Day 12	1	ND	ND
			2	ND	ND
June 19	Spray 3	Day 1	1	ND	ND
			2	ND	ND
South					
May 21	Spray 1	Background		--[c]	--
May 22		Day 1	1	0.10	ND
			2	ND	ND
May 29		Day 8[b]	1	6.54	3.39
			2	6.30	3.92
June 2		Day 12	1	0.10	ND
			2	0.12	ND
June 5	Spray 2	Day 1	1	ND	ND
			2	ND	ND
June 9		Day 5[b]	1	11.27	9.07
			2	11.89	9.03
June 16		Day 12	1	ND	ND
			2	ND	ND
June 19	Spray 3	Day 1	1	ND	ND
			2	ND	ND

[a]Not detected. Minimum detection level was 0.1 ppb.
[b]Samples were collected within 24 hrs after rainfall occurred.
[c]Not sampled.

Air

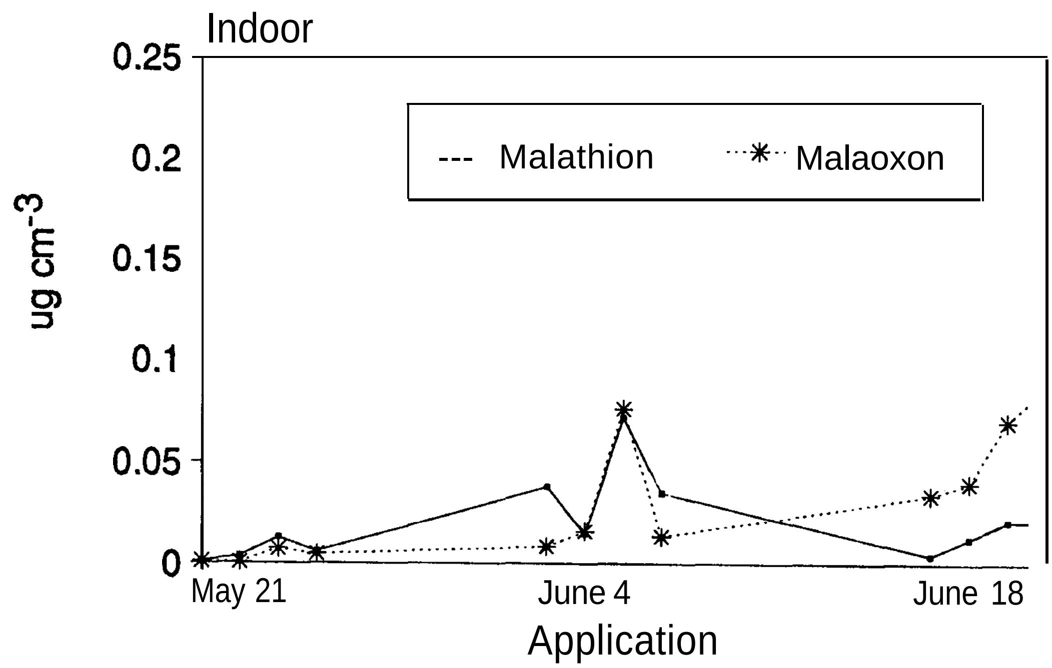
Quality control laboratory spikes averaged 91 percent recovery for both malathion and malaoxon (Appendix C), and 6 laboratory and 2 field blanks showed no detectable levels of either chemical.

Indoor and outdoor air samples collected before, during and after each application at four sites within the treatment area indicated that the highest malathion concentration measured was 0.48 $\mu g\ m^{-3}$ (36 parts per trillion) during indoor monitoring of a spray interval. The highest malaoxon concentration was 0.27 $\mu g\ m^{-3}$ (21 ppt), measured during indoor monitoring at the second post-spray interval (Table 6). Average malathion concentrations were generally higher than malaoxon concentrations during monitoring (Table 6, Figure 5). An exception to these results occurred at indoor sites during the third application. The average malaoxon concentration was higher because extremely high values were observed at one site. A gasoline container was found at this indoor site and may have influenced the results. Aside from this exception, other reported malaoxon values may have been artificially inflated because the high volume sampling method used could have increased malathion oxidation to malaoxon. Even though air concentrations of malathion and malaoxon rose and fell during and after each application, respectively, there was no evidence of cumulative increase in ambient air concentrations throughout the entire treatment period. Outdoor concentrations of malathion were higher than those found indoors, while outdoor and indoor concentrations of malaoxon were very similar (Figure 6). Malathion and malaoxon air concentrations both indoors and outdoors during the Mexican fruit fly eradication program were generally higher than the 1990 Mediterranean fruit fly air

Table 6. Malathion and malaoxon air concentrations for all applications.

Analyte	Statistic	Background	Spray	1st Post-Spray	2nd Post-Spray
		$\mu g\ m^{-3}$			
Malathion Indoor	No. Samples	12	12	12	12
	Mean	0.0143	0.0527	0.0350	0.0201
	Standard Error	0.0064	0.0388	0.0164	0.0074
	Minimum	ND[a]	ND	ND	ND
	Maximum	0.0610	0.4755	0.2098	0.0962
Malathion Outdoor	No. Samples	11	11	11	12
	Mean	0.0028	0.1715	0.1483	0.0703
	Standard Error	0.0012	0.0415	0.0251	0.0158
	Minimum	0.0001	0.0125	0.0431	0.0080
	Maximum	0.0125	0.1257	0.2992	0.2057
Malaoxon Indoor	No. Samples	12	12	12	12
	Mean	0.0144	0.0142	0.0507	0.0338
	Standard Error	0.0097	0.0066	0.0183	0.0218
	Minimum	ND	ND	ND	
	Maximum	0.1203	0.0779	0.1742	0.299
Malaoxon Outdoor	No. Samples	11	11	11	12
	Mean	0.0612	0.0101	0.0623	0.0401
	Standard Error	0.0021	0.0145	0.0164	0.0078
	Minimum	0.0002	ND	0.0183	0.0059
	Maximum	0.0215	0.0516	0.2171	0.0980

[a]Not detected. Minimum detection limit was 0.1 μg per sample. One-half of the detection limit was used for calculations when residues were not detectable.



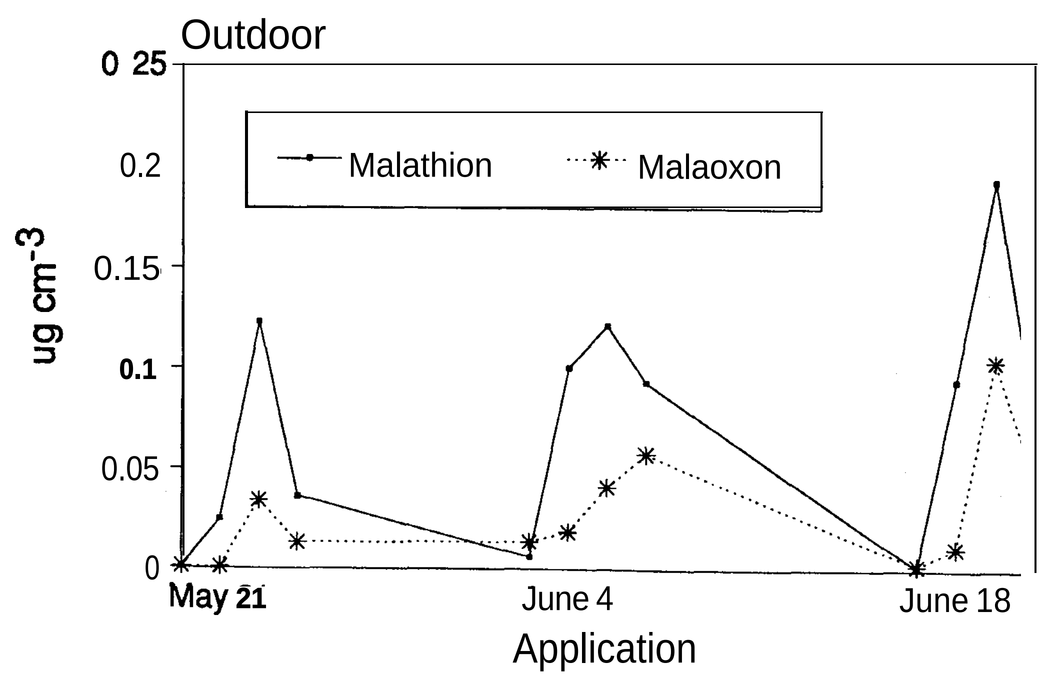


Figure 5. Average malathion and malaoxon concentrations in air indoors and outdoors during each of three applications (n=4).

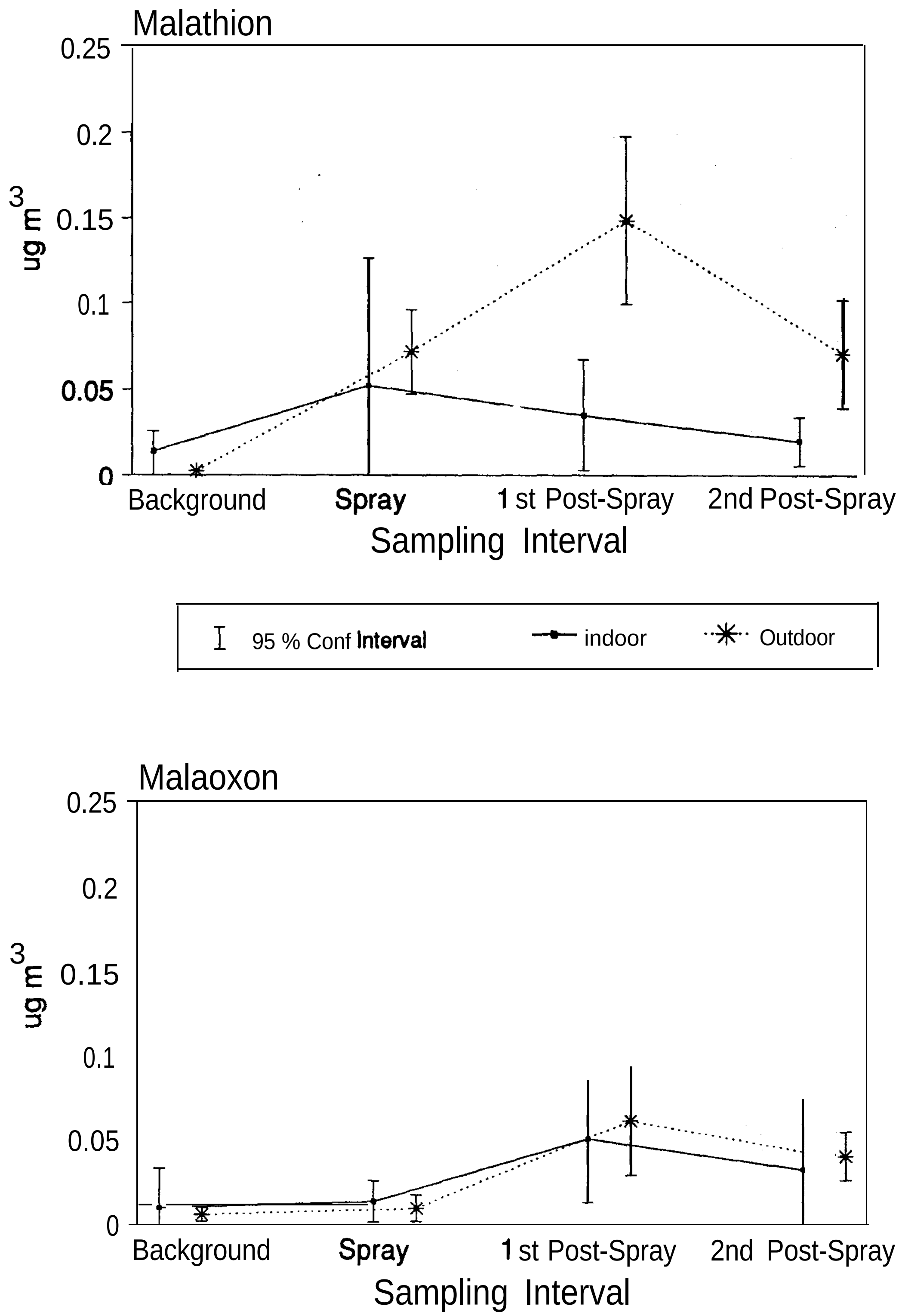


Figure 6. Average malathion and malaoxon concentrations in air indoors and outdoors for all applications combined (n-l 2).

monitoring results. No statistical tests were used to compare the two distributions because of the small sample sizes for the Mexican fruilt fly eradication program, but the lower, middle and upper third of their combined distributions are graphed in Figures 7 and **8.** In all cases except during background monitoring outdoors (Figure **8a),** a greater percentage of Mexican fruit fly air samples than the Medfly air samples fell into the highest interval.

Additional Monitoring

Field personnel collected water samples and several dead goldfish from a small private pool at the request of the owner. Analysis of water samples showed no presence of malathion or malaoxon. The fish sample was insufficient for analysis but since the water samples were negative, it was concluded that malathion was not responsible for the kill.

CONCLUSIONS

Environmental monitoring results indicated that malathion treatment for eradication of the Mexican fruit fly in El Cajon was similar to the Mediterranean fruit fly treatment program in Los Angeles County that was conducted earlier in the year. Malathion mass deposition for this program was not significantly different from deposition results during the 1990 Mediterranean fruit fly program. Droplet sizes encountered during the applications were slightly smaller than those calculated for the Mediterranean fruit fly eradication program. Local topography necessitated variable flight elevations for the aerial applications which may have affected droplet size during deposition. Smaller droplets could cause an increase in pesticidal

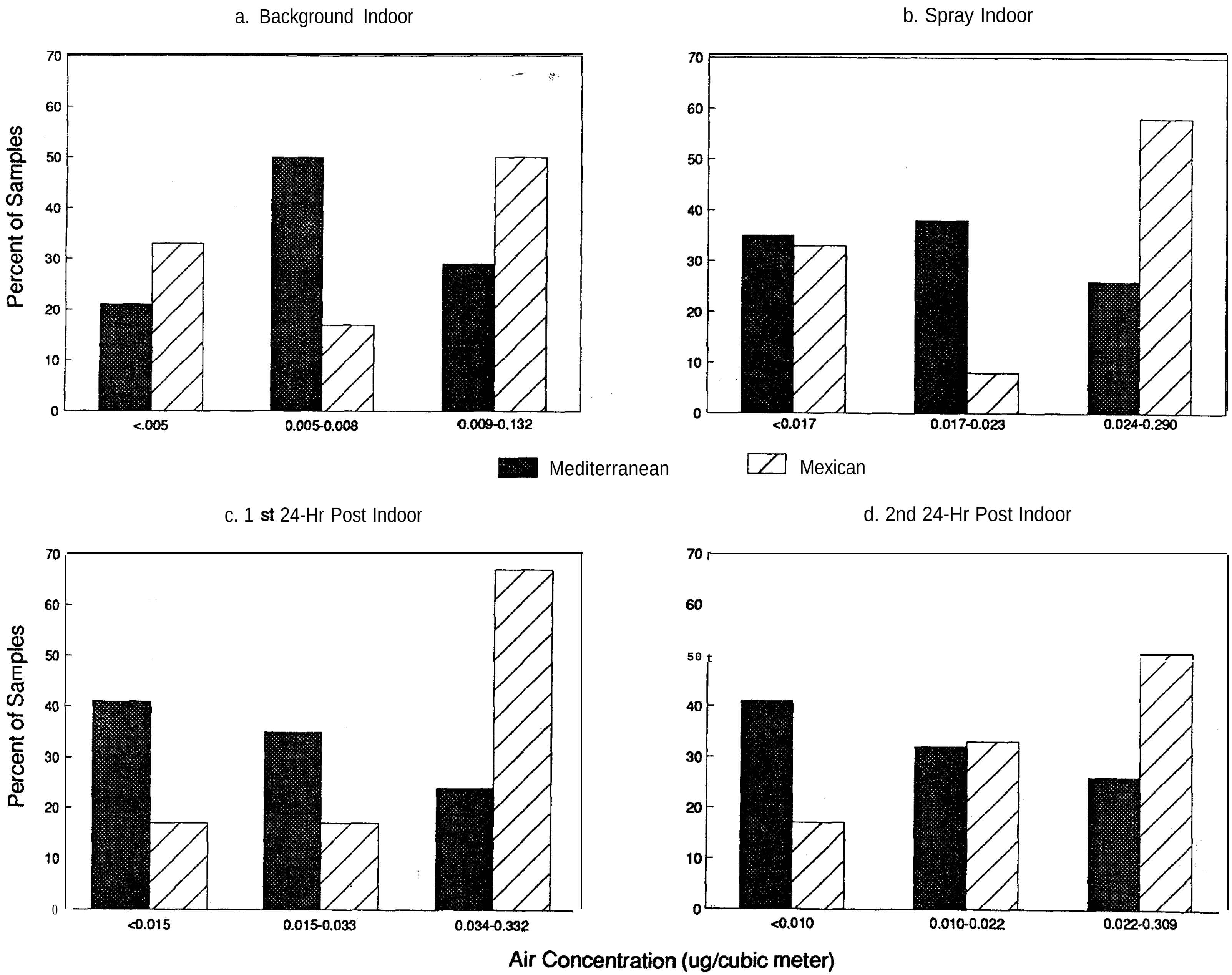


Figure 7. Comparison of Mexican and Mediterranean fruit fly malathion indoor air samples within the lower, middle and upper third of their combined distributions.

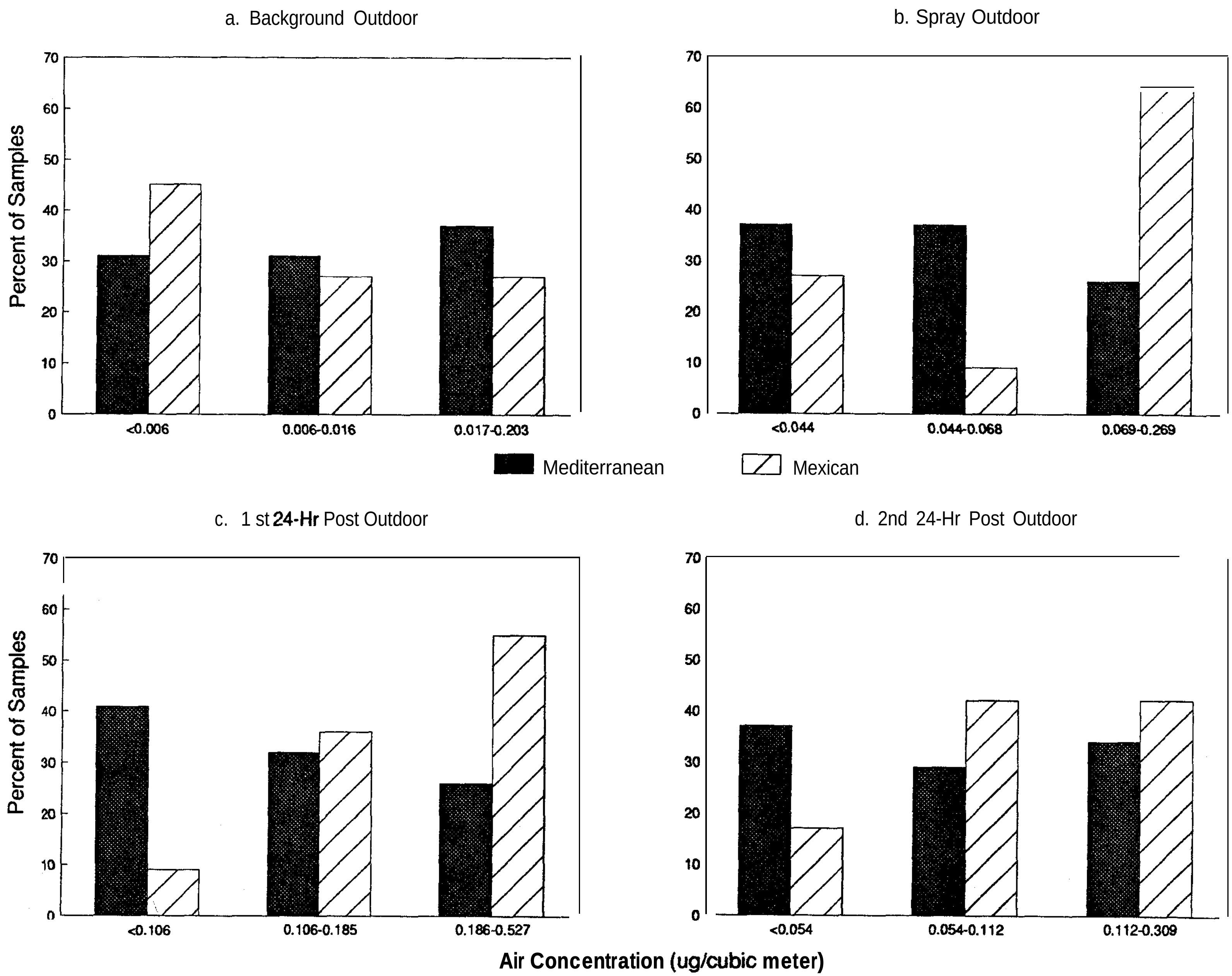


Figure 8. Comparison of Mexican and Mediterranean fruit fly malathion outdoor air samples within the lower, middle and upper third of their combined distributions.

drift and volatilization, accompanied by increased suspension in the atmosphere.

Surface water concentrations of malathion and malaoxon were within the range of previous eradication monitoring results. No unusual levels of malathion were measured in confined surface waters, even though malathion was found in pond water at a site that had been flagged. The presence of malathion in runoff water immediately after rainfall events indicated that malathion can be expected to move out of a treatment area for a unknown period of time after an application if rainfall occurs. Although malathion levels monitored were low, it is possible that aquatic biota may be affected. Since no biological monitoring was undertaken, these effects remain unknown.

Average malathion and malaoxon air concentrations were greater than those measured during Medfly monitoring, but were low in comparison to any air quality criteria used by the California Department of Health Services. Increased ambient concentrations during the spray and post-spray sampling intervals are not explainable since mass deposition on the ground was not significantly different for both eradication programs. As expected, the malathion outdoor concentrations were greater than indoor levels, and malathion was more prevalent in air than malaoxon. The true proportions of malathion and malaoxon were unmeasurable due to the artificial oxidation promoted by the high volume sampling method employed. Ozone was also a possible contributor to malathion oxidation. As stated previously in the Mediterranean fruit fly report, oxidation tests performed during monitoring would be the best way to determine relative proportions of the two chemicals.

The Mexican fruit fly eradication program was effectively monitored by the CDFA Environmental Hazards Assessment Program. Results of this monitoring program indicate that the malathion treatment in El Cajon was similar to recent Mediterranean fruit fly eradication efforts and that no unusual application events occurred during the program,

LITERATURE CITED

Dowell, R. V., revised 1990. Action plan for Mexican fruit fly. California Department of Food and Agriculture, Division of Plant Industry, Pest Detection/Emergency Projects Branch.

Murphy, B. and R. Coronado. 1986. Mexican fruit fly (*Anastrepha ludens*) biology and control. California Department of Food and Agriculture Exotic Pest Analysis Staff and Pest Management Analysis and Planning.

Segawa, R., J.A. Sitts, J.H. White, S.J. Marade, and S.J. Powell. 1990. Environmental monitoring of malathion aerial applications used to eradicate Mediterranean fruit flies in southern California, 1990. California Department of Food and Agriculture Report.

APPENDIX A

ANALYTICAL METHODS FOR MASS DEPOSITION, WATER AND AIR SAMPLES

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CHEMISTRY LABORATORY SERVICES
ENVIRONMENTAL MONITORING SECTION
3292 Meadowview Road
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(916) 427-4649/4999

Original Date: 06/09/89
Supercedes: New
Current Date: 07/30/90
Method #:

MALATHION AND MALAOXON ON MASS DEPOSITION SAMPLES

SCOPE:

This method is for the determination of malathion and malaoxon on Kimbie® or Teflon® cards.

PRINCIPLE:

Residues of malathion and malaoxon were extracted from Kimbies® (asbordant towel with a plastic backing) by shaking them with ethyl acetate. The extract was then concentrated for malaoxon and analyzed by gas chromatograph using a flame photometric detector(FPD). Since the levels of malathion were in milligram amounts an aliquot was taken and diluted. It was then analyzed by gas chromatography using a Thermionic Specific Detector® (TSD).

REAGENTS AND EQUIPMENT:

Ethyl acetate; (pesticide residue grade).
Wide-mouth mason jars (quart size).
Mechanical shaker (G10 Gyrotory Shaker).
Boiling flasks, flat bottom with ground glass joint 24/40 (300 mL).
Rotary evaporator (Büchi/Brinkmann, R110).
Graduate test tubes (15 mL).
Nitrogen evaporator (Organomation Model # 12)
Vibrating mixer for test tubes
Graduated cylinder (1 L).
Kimbie® (Kimberly-Clark Corp.)

ANALYSIS:

Place the Kimbie® in a quart mason jar. Add 500 mL of ethyl acetate and shake.on a mechanical shaker for 30 min. at a setting of ~ 165 RPM.

Malaoxon

1) Take 100 mL of extract to be analyzed for malaxon and concentrate down just to dryness on a rotary evaporator. Rinse sides of flask with a few milliters of ethyl acetate.

2) Transfer extract to a graduated test tube. Rinse flask 3 times each with 2 mL of ethyl acetate. Transfer each wash to the same graduated test tube.

3) Place extract on a nitrogen evaporator with waterbath set at 35°C and evaporate to a final volume of 1 mL under a gentle stream of nitrogen.
4) Stopper the graduated test tube and mix contents by placing on a vibrating mixer for about 15 seconds. Submit sample for gas chromatogaphic analysis.

Malathion

1) Take 1 mL aliquot of the initial ethyl acetate extract and dilute 1:2 with ethyl acetate. Submit sample for gas chromatographic analysis.

EQUIPMENT CONDITIONS:

MALAOXON
VARIAN 3700 GC with FPD
Column: DB-1701 (7% cyanopropyl & 7% phenol polysiloxane) 30 m x 0.552 mm x 1.0 um
Carrier gas: Helium, flow rate: 15 psi.
Injector: 200°C.
Detector: 250°C.
Temperature: 195°C isothermal.
Injection volume: 2 uL.
Retention times: Malathion 8.82 ± 0.1 min. Malaoxon 7.86 ± 0.1 min.
Linearity checked: 0.2 ng - 20 ng.

MALATHION
VARIAN 6000 GC WITH TSD
Column: DB-1301 (6% cyanoproylphenyl & 94% methyl) 30 m x 0.55 mm x 1.0 um
Carrier gas: Helium, flow rate: 20 psi.
Injector: 220°C.
Detector: 300°C.
Temperature: 185°C isothermal.
Injection volume: 2 uL.
Retention times: Malathion 6.24 ± 0.05 Malaoxon 5.17 ± 0.05
Linearity checked: 0.2 ng - 10 ng.

CALCULATIONS:

Micrograms (UC) MALAOXON

$$\text{ug in sample} = \frac{\text{(peak height sample)(ng/uL std)(uL injected std)(500 mL)(final volume ml)}}{\text{(peak height std)(uL injected sample)(100 mL)}}$$

Micrograms (UG) MALATHION

$$\text{ug in sample} = \frac{\text{(peek height sample)(ng/uL std)(uL Injected std)(final volume mLs)}}{\text{(peak height std)(uL injected sample)(100 mL)}}$$

FORTIFICATION:

Malathion and malaoxon were spiked onto separate Kimbie® sheet at the levels listed below. The Kimbies® were allowed to dry before extracting them.

RECOVERIES:

% Recoveries of malathion and malaoxon

Levels	Malathion(mean)	Malaoxon(mean)
10 ug (n-2)	96	110
100 ug (n-2)	83	92
1000 ug (n-2)	108	98
5000 ug (n-2)	103	98

Recovery validation was done prior to the samples.

MINIMUM DETECTABLE LEVEL:

1.0 ug (1 kimbie per sample) S/N-4

DISCUSSION:

Each run contained stds of .1 ng/uL, 1 ng/uL, 2.5 ng/uL, 5 ng/uL and 10 ng/uL at the begin and end. A 1 ng/uL, 2.5 ng/uL and 5 ng/uL were run after every 10-12 samples. A separate spike for malathion and malaoxon at a 1000 ug level was done for each set of sample.

REFERENCE:

1) White, Jane., *Parathion on Kimbies*, 1989 Environmental Monitoring Methods, California Department of Food and Agriculture

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(916) 427-4649/4999

Original Date: 06/09/89
Supercedes: New
Current Date: 07/27/90
Method #:

MALATHION AND MALAOXON IN WATER

SCOPE:

This method is for the determination of malathion and malaoxon in water.

PRINCIPLE:

The samples of water were extracted by shaking in a separatory funnel with methylene chloride. The extract was filtered and evaporated to dryness. It was then transferred and brought up to final volume with acetone. The extract was analyzed by gas chromatography using a flame photometric detector (FPD).

REAGENTS AND EQUIPMENT:

Methylene chloride and acetone (pesticide residue grade)
Sodium sulfate (anhydrous)
Separatory funnels (2 L)
Boiling flasks, flat bottom with ground glass joint 24/40 (500 mL)
Glass stem funnels (65 mm/75 mm)
Rotary evaporator (Büchi/Brinkmann, R110)
Graduate test tubes (15 mL)
Nitrogen evaporator (Organomation Model # 12)
Vortex mixer for test tubes
Balance (Mettler PC 4400)
Filter paper (Whatman #4, 12.5 cm)

ANALYSIS:

1) Remove samples from refrigerated storage and allow them to come to room temperature. Samples consist of approximately 1 L and are stored in 1 L amber glass bottles to prevent any photodegradation from occurring.

2) Record weight of the sample by weighing sample bottle before and after transfer.

3) Extract sample by shaking with 100 mL of methylene chloride for 2 min.

4) Allow layers to separate and filter the organic layer through 25 g anhydrous sodium sulfate and filter paper. Collect extract in a 500 mL boiling flask.

5) Repeat steps 3 & 4 two more times using 80 mL of methylene chloride each time.

6) Rinse sodium sulfate with 20 mL additional methylene chloride and collect in the same 500 mL boiling flask.

7) Take extract just to dryness on a rotary evaporator. Add a 1-2 mL acetone to the flask to rinse down the sides.

8) Transfer extract to a graduated test tube. Rinse flask 3 times each with 2 mL of acetone. Transfer each wash to the same graduated test tube.

9) Place extract in a nitrogen evaporator with waterbath set at 35°C and evaporate to a final volume of 1 mL under a gentle stream of nitrogen.

10) Stopper the graduated test tube and mix contents by placing on a vibrating mixer for about 15 seconds. Submit sample for gas chromatographic analysis.

EQUIPMENT CONDITIONS:

PRIMARY ANALYSIS
Varian: 3700 GC with FPD
Column: DB-1701 (7% cyanopropyl & 7% phenol polysiloxane) 30 m x 0.552 mm x 1.0 um
Carrier gas: Helium, Flow rate: 20 mL/min.
Injector: 200°C.
Detector: 250°C.
Temperature: 195°C isothermal
Injection volume: 2 uL
Retention times: Malathion 8.82 ± 0.1 min. Malaoxon 7.86 ± 0.1 min.
Linearity checked: 0.2 ng - 20 ng

CONFIRMATION ANALYSIS
Varian: 3700 GC WITH FPD
Column: DB-210 (50% tri-fluoropropyl methyl polysiloxane) 15 m x 0.537 mm x 1.0 um
Carrier gas: Helium, Flow rate: 17 mL/min.
Injector: 220°C.
Detector: 260°C.
Temperature program: Initial Temp: 130°C held for 2 minutes.
Rate: 20°C/minute.
Final Temp: 180°C held for 3 minutes.
Injection volume: 2 uL
Retention times: Malathion 2.78 ± 0.1 min. Malaoxon 3.17 ± 0.1 min.
Linearity checked: 0.2 ng - 20 ng

CONFIRMATION ANALYSIS
Hewlett Packard 5880 A GC with FPD
Column: HP-1 (100% methyl polysiloxane) 10 m x 0.52 mm x 1.0 um
Carrier gas: Helium; Flow rate: 20 mL/min.
Injector: 220°C.
Detector: 250".
Temperature: 170°C isothermal
Injection volume: 2 uL
Retention times: Malathion 5.21 ± 0.1 min. Malaoxon 3.85 ± 0.1 min
Linearity checked: 0.2 ng - 20 ng

CALCULATIONS:

PPB MALATHION AND MALAOXON

$$\text{ppb in sample} = \frac{(\text{peak height sample})(\text{ng/uL std})(\text{uL injected std})(\text{final volume mLs})(1000)}{(\text{peak height std})(\text{uL injected sample})(\text{weight of sample g})}$$

FORTIFICATION:

Malathion and malaoxon were spiked into separate 1 L volumes of water at the levels listed below.

RECOVERIES:

% Recoveries of malathion and malaoxon

Levels	Malathion(mean)	Malaoxon(mean)
0.5 ppb (n-2)	99	138
5.0 ppb (n-2)	106	124
50.0 ppb (n-2)	106	101
500 ppb (n-2)	103	96

Recovery validation was done prior to samples.

MINIMUM DETECTABLE LEVEL:

The minimum detectable level was 0.1 ppb (1 liter volume of sample used.) S/N-4

DISCUSSION:

At the beginning and end of each run standards were run consisting of 0.1, 1, 2.5, 5 and 10 ng/uL. A 1, 2.5 and 5 ng/uL standards were run after every 10-12 samples. A separate 5 ppb spike for malathion and malaoxon was done with each set of samples.

REFERENCE:

1) White, Jane, ***Diazinon, Chlorpyrifos,*** Parathion and ***Methidathion In Fog Water***, 1989, Environmental Monitoring Methods, California Department of Food and Agriculture.

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Original Date: 06/09/89
Supercedes: New
Current Date: 08/02/90
Method #:

MALATHION AND MALAOXON IN HIGH VOLUME AIR SAMPLER RESIN

SCOPE:

This method is for the determination of malathion and malaoxon in high volume air samplers containing XAD-2® resin.

PRINCIPLE:

Malathion and Malaoxon were extracted from XAD-2® resin with acetone. The solvent was rotary evaporated to dryness and the residues were brought back up to a final volume with acetone. The extract was analyzed using gas chromatography and a flame photonstric detector (FPD).

REAGENTS AND EQUIPMENT:

Acetone; (pesticide residue grade)
Ultrasonic bath (Branson B72).
Chromatographic columns (19 mm by 500 mm Kimble).
Boiling flasks, flat bottom with ground glass joint 24/40 (500 mL).
Wide-mouth mason jars (pint size).
Rotary evaporator (Büchi/Brinkmann, R110).
Graduate test tubes (15 mL).
Nitrogen evaporator (Organomation Model # 12).
Vortex mixer for test tubes.
XAD-2® (Rohm and Haas);hexane-acetone soxhlet washed.

ANALYSIS:

1) Empty resin from the high volume air sampler into a wide mouth mason jar.

2) Add 150 mL of acetone to the mason jar. Cover the jar with foil and cap. Place it into an ultrasonic bath for 30 minutes.

3) Pour solvent and resin into a 19 mm diameter by 500 mm long chromatography column with a glass wool plug at the outlet end.

4) Allow solvent to flow from the column at a rate of 2-3 ml/minute into a 500 mL boiling flask.

5) Rinse the mason jar from step #1 with 100 mL of acetone; pour the solvent and any remaining resin into the column.

6) Allow solvent to elute into the same flask as before.

7) Elute column with an additional 50 mL of acctune.

8) Rotary evaporate the extract just to dryness at 35°C at approximately 20 mm Hg vacuum,

9) Add 1 mL of acetone to the flask. Then transfer the extract to a graduated test tube. Wash the flask 3 times each with 2 mL of acetone. Transfer each wash to the same graduated test tube.

10) Place extract on a nitrogen evaporator with waterbath set at 35°C and evaporate to a final volume of 1 mL under a gentle stream of nitrogen.

11) Stopper the graduated test tube and mix the contents by placing on a vortex mixer for about 15 seconds. Submit sample for gas chromatographic analysis,

EQUIPMENT CONDITIONS:

PRIMARY ANALYSIS
Varian. 3700 GC with FPD
Column: DB-1701 (7% cyanopropyl & 7% phenol polysiloxane) 30 m x 0,552 mm x 1.0 unl
Carrier gas: Helium, Flow rate: 20 mL/min.
Injector: 200°C.
Detector: 250°C.
Temperature: 195°C isothermal
Injection volune: 2 uL
Retention times: Malathion 8.82 ±0.10 min. Malaoxon 7.86 ±0.10 min.
Linearity checked: 0.2 ng - 20 ng

CONFIRMATION ANALYSIS
VARIAN 3700 GC with FPD
Column: DB-210 (50% tri-fluoropropyl methyl polysiloxane) 15 m x 0.537 mm x 1.0 um
Carrier gas: Helium, flow rate: 14 psi
Injection: 220°C.
Detector: 260°C.
Temperature program: Initial Temp: 130°C held for 2 minutes.
Rate: 20°C / minute.
Final Temp: 180°C held for 3 minutes,
Injection volume: 2 uL
Retention times: Malathion 2.78 ±0.10 min. Malaoxon 3.17 ±0.10 min.
Linearity checked: 0.2 ng - 20 ng

CONFIRMATION ANALYSIS
HEWLETT PACKARD 5880A CC with FPD
Column: HP-1 (100% methyl polysiloxane) 10 m x 0.52 mm x 1.0 um
Carrier gas: Helium, flow rate: 20 psi
Injector: 220°C.
Detector: 250°C.
Temperature: 170°C held for 7 minutes,
Injection volume: 2 uL
Retention times: Malathion 5.21 ±0.10 min. Malaoxon 3.85 ±0.10 min.
Linearity checked: 0.2 ng - 20 ng

CALCULATIONS:

Micrograms (UG) Malathion and Malaoxon

$$\text{ug in sample} = \frac{(\text{peak height sample})(\text{ng/uL std})(\text{uL injected std})(\text{final volume mLs})}{(\text{peak height std})(\text{uL sample injected})}$$

MINIMUM DETECTABLE LEVEL:

0.1 ug (125 mL resin in high volume air sampler) S/N=4

DISCUSSION:

Method validation was based on low volume air samplers validation. A separate spike for malathion and malaoxon at a 5 ug level was done for every 10 samples.

Due to-the nature of the samples the injector liner had to be changed after every 20 samples to insure the minumum detectable limit.

REFERENCE:

1.) Echelberry, Jim., ***Organophoshate Pesticides In High Volume Air Samples***, 1989 Environmental Monitoring Methods, California Department of Food and Agriculture.

2.) Schlocker, Peter L., ***Wilder Ranch - Miscellaneous Organophosphate*** Pesticides in ***Low*** Volume Air ***Sampler Resin Samples***, 1983 Environmental Monitoring Methods, California Department of Food and Agriculture.

WRITTEN BY: Jane White

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REVIEWED BY: Catherine Cooper

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APPROVED: Terry Jackson

Terry Jackson

TITTLE: Quality Assurance Officer

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Tom Joe (Acting)

TITLE: Research Agricultural Chemist

APPENDIX B

FIELD DATA FOR MASS DEPOSITION, DROPLET SIZE DISTRIBUTION, AND AIR MONITORING SAMPLES

Sample #	Date Collected	Site	Sample Type	Malathion (ug/sample)	Maiaoxon (ug/sample)	Malaoxon converted to Malath	Total as Malathion
85	5/21/90	A 0 1	FAL	1773.69	2.05	2.15	1775.84
86	5/21/90	A 0 2	FAL	1911.82	1.72	1.81	1913.63
87	5/21/90	A 0 3	FAL	2536.45	2.45	2.57	2539.02
88	5/21/90	A 0 4	FAL	2950.03	3.04	3.20	2953.23
89	5/21/90	A 0 5	FAL	1464.99	1.27	1.33	1466.32
90	5/21/90	A 0 6	FAL	4357.21	3.37	3.54	4360.75
91	5/21/90	A 0 7	FAL	2085.69	1.53	1.61	2087.30
92	5/21/90	A 0 8	FAL	514.33	0	0.00	514.33
12	5/21/90	A 0 9	FAL	1384.08	2.27	2.39	1386.47
13	5/21/90	A 0 10	FAL	2636.65	3.28	3.45	2640.10
14	5/21/90	A 0 11	FAL	1564.79	2.04	2.14	1566.93
17	5/21/90	A 0 12	FAL	2586.83	4.24	4.46	2591.29
18	5/21/90	A 0 13	FAL	1051.5:	1.49	1.57	1053.10
19	5/21/90	A 0 14	FAL	429.62	0	0.00	429.62
15	5/21/90	A 0 15	FAL	1678.11	1.93	2.03	1680.14
16	5/21/90	A 0 16	FAL	1476.19	1.85	1.94	1478.13
100	5/21/90	A 0 17	FAL	4407.16	6.7	7.04	4414.20
99	5/21/90	A 0 18	FAL	2521.23	4.83	5.08	2526.31
98	5/21/90	A 0 19	FAL	976.2	2.18	2.29	978.49
97	5/21/90	A 0 20	FAL	625.55	0	0.00	625.55
96	5/21/90	A 0 21	FAL	1141.02	3.01	3.16	1144.18
1354	6/4/90	A 0 1	FAL	4079.78	2.93	3.08	4082.86
1355	6/4/90	A 0 2	FAL	3743.57	4.86	5.11	3748.68
1348	6/4/90	A 0 4	FAL	470.64	1.09	1.15	471.79
1344	6/4/90	A 0 5	FAL	366.45	0.5	0.53	366.98
1386	6/4/90	A 0 6	FAL	159.02	0.5	0.53	159.55
1385	6/4/90	A 0 7	FAL	64.9	0.5	0.53	65.43
1384	6/4/90	A 0 8	FAL	2220.04	2.45	2.57	2222.61
1387	6/4/90	A 0 9	FAL	1899.66	1.53	1.61	1901.27
1303	6/4/90	A 0 10	FAL	3245.12	3.35	3.52	3248.64
84	6/4/90	A 0 11	FAL	730.39	2.33	2.45	732.84
1304	6/4/90	A 0 12	FAL	927.29	1.68	1.77	929.06
1306	6/4/90	A 0 13	FAL	3211.63	3.28	3.45	3215.08
1307	6/4/90	A 0 14	FAL	1539.14	1.64	1.72	1540.86
1308	6/490	A o 15	FAL	2206.1	1.49	1.57	2207.67
1293	6/4/90	A O 17	FAL	1088.43	4.21	4.42	1092.85
1392	6/4/90	A 0 19	FAL	2572.75	18.25	19.18	2591.93
3079	6/4/90	A 0 20	FAL	76.82	0.5	0.53	77.35
3077	6/4/90	A 0 21	FAL	3102.93	2.38	2.50	3105.43
1294	6/4/90	A 0 24	FAL	1672.39	3.09	3.25	1675.64
1337	6/4/90	A 0 25	FAL	1105.93	1.47	1.54	1107.47
1397	6/4/90	A 0 26	FAL	2468.23	3.80	3.99	2472.22
80	6/18/90	A 0 1	FAL	2503.16	7.37	7.75	2510.91

Sample #	Date Collected	Site			Sample Type	Malathion (ug/sample)	Malaoxon (ug/sample)	Malaoxon converted to Malath	Total as Malathion
70	6/18/90	A	0	2	FAL	2189.17	4.91	5.16	2194.33
71	6/18/90	A	0	4	FAL	1568.73	3.35	3.52	1572.25
78	6/18/90	A	0	5	FAL	571.34	1.34	1.41	572.75
77	6/18/90	A	0	6	FAL	3232.46	10.50	11.04	3243.50
76	6/18/90	A	0	7	FAL	684 1.23	6.75	7.09	6848.32
75	6/18/90	A	0	8	FAL	1761.83	3.44	3.62	1765.45
61	6/18/90	A	0	9	FAL	1332.95	8.16	8.58	1341.53
62	6/18/90	A	0	10	FAL	2827.3	5.55	5.83	2833.13
63	6/18/90	A	0	11	FAL	1504.25	1.43	1.50	1505.75
64	6/18/90	A	0	12	FAL	343.34	0.5	0.53	343.87
65	6/18/90	A	0	13	FAL	869.48	4.10	4.31	873.79
66	6/18/90	A	0	14	FAL	465.57	2.59	2.72	468.29
67	6/18/90	A	0	15	FAL	2545.57	0.5	0.53	2546.10
60	6/18/90	A	0	17	FAL	4015.7	6.39	6.72	4022.42
57	6/18/90	A	0	19	FAL	869.83	4.57	4.80	874.83
56	6/18/90	A	0	20	FAL	2320.62	9.15	9.62	2330.24
55	6/18/90	A	0	21	FAL	2423.65	3.56	3.74	2427.39
59	6/18/90	A	0	24	FAL	1357.41	5.65	5.94	1363.35
79	6/18/90	A	0	25	FAL	1409.23	3.68	3.87	1413.10
68	6/18/90	A	0	26	FAL	1363.35	1.68	1.77	1365.12
4	6/18/90	A	0	27	FAL	2270.33	4.39	4.61	2274.94

Mexican fruit fly droplet size distribution measurements Droplet Diameter MEXDROP.XLS

Spray No	Site	Date	Area, sq cm		46-60	60-80	80-108	108-147	147-202	202-279	279-387	387-538	538-747	747-1034	1034-1422	1422+	Drops Counted	Drops/ sq ft
1	A01	5/21/90	38.1		0	0	0	0	1	0	2	2	2	1	4	0	12	13.95349
1	A02	5/21/90	38.1		0	1	1	6	8	5	7	3	2	0	1	0	34	39.53488
1	A03	5/21/90	38.1		0	0	1	2	3	4	2	0	1	0	2	1	16	18.60465
1	A04	5/21/90	38.1		0	0	3	7	8	8	2	2	3	3	0	0	36	41.86047
1	A05	5/21/90	38.1		0	0	0	0	7	8	1	2	0	0	0	0	18	20.93023
1	A06	5/21/90	38.1		0	0	1	1	6	12	4	2	0	1	1	1	29	33.72093
1	A07	5/21/90	38.1		0	0	4	6	12	7	0	0	0	3	1	2	35	40.69767
1	A08	5/21/90	38.1		0	0	3	10	15	2	0	0	0	0	0	0	30	34.88372
1	A09	5/21/90	38.1		0	0	0	0	0	1	5	5	2	3	0	0	16	18.60465
1	A10	5/21/90	38.1		0	0	0	0	1	4	9	5	0	3	1	1	24	27.90698
1	A11	5/21/90	38.1		0	0	0	3	8	8	2	4	4	3	0	0	32	37.2093
1	A12	5/21/90	38.1		0	0	2	12	12	15	20	6	3	3	1	0	74	86.04651
1	A13	5/21/90	38.1		0	0	0	0	4	4	6	1	0	1	0	0	16	18.60465
1	A14	5/21/90	38.1		0	0	0	7	15	6	0	1	1	0	0	0	30	34.88372
1	A15	5/21/90	38.1		0	0	0	11	9	10	11	0	0	0	0	0	41	47.67442
1	A16	5/21/90	38.1		0	0	0	13	17	4	0	0	0	0	0	1	35	40.69767
1	A17	5/21/90	38.1		0	0	0	4	10	9	4	3	0	1	2	0	33	38.37209
1	A18	5/21/90	38.1		0	0	7	9	11	10	11	2	0	2	3	4	59	68.60465
1	A19	5/21/90	38.1		0	1	5	11	5	4	10	3	3	0	0	0	42	48.83721
1	A20	5/21/90	38.1		0	0	1	10	12	3	4	0	1	0	0	0	31	36.04651
1	A21	5/21/90	38.1		0	0	2	3	9	12	5	9	2	0	0	0	42	48.83721
1	A22	5/21/90	38.1	Not sprayed														
1	A23	5/21/90	38.1	Not sprayed														
		TOTAL			0	2	30	115	173	136	105	50	24	24	16	10	685	796.5116
		% total			0	0.291971	4.379562	16.78832	25.25547	19.85401	15.32847	7.29927	3.50365	3.50365	2.335766	1.459854	100	
		Density	drops/sq ft		0	2.325581	34.88372	133.7209	201.1628	158.1395	122.093	58.13953	27.90698	27.90698	18.60465	11.62791		796.5116
2	A01	6/4/90	38.1		0	0	2	11	15	9	3	1	2	1	2	1	47	57.31707
2	A02	6/4/90	38.1		0	0	1	12	14	6	3	2	1	2	4	1	46	56.09756
2	A04	6/4/90	38.1		0	0	2	10	6	14	3	0	0	0	0	0	35	42.68293
2	A05	6/4/90	38.1		0	0	2	8	4	6	2	0	0	0	0	0	22	26.82927
2	A06	6/4/90	38.1		0	0	3	9	3	0	0	0	0	0	0	0	15	18.29268
2	A07	6/4/90	38.1		0	0	0	2	0	0	0	0	0	0	0	0	2	2.439024
2	A08	6/4/90	38.1		0	0	2	13	15	4	6	0	0	0	0	0	40	48.78049
2	A09	6/4/90	38.1		1	0	2	3	7	5	5	4	4	2	1	0	34	41.46341
2	A10	6/4/90	38.1		0	2	2	5	5	4	5	8	4	1	1	0	37	45.12195

Mexican fruit fly droplet size distribution measurements Droplet Diameter MEXDROP.XLS

Spray	No	Site	Date	Area, sq cm		46-60	60-80	80-108	108-147	147-202	202-279	279-387	387-538	538-747	747-1034	1034-1422	1422+	Drops Counted	Drops/ sq ft
2		A11	6/4/90	38.1		0	0	0	7	12	4	5	1	1	0	0	0	30	36.58537
2		A12	6/4/90	38.1		0	0	0	12	1	1	6	0	2	0	0	0	22	26.82927
2		A13	6/4/90	38.1		0	0	0	10	14	8	7	5	0	2	0	0	46	56.09756
2		A14	6/4/90	38.1		0	0	0	8	16	23	10	4	0	0	0	0	61	74.39024
2		A15	LOST																
2		A17	6/4/90	38.1		0	1	0	8	5	9	5	1	3	1	0	0	33	40.2439
2		A19	6/4/90	38.1		0	0	0	9	21	14	12	3	3	0	0	0	62	75.60976
2		A20	6/4/90	38.1		0	0	0	4	3	0	0	0	0	0	0	0	7	8.536585
2		A21	6/4/90	38.1		0	0	1	4	11	15	9	2	0	3	0	1	46	56.09756
2		A24	6/4/90	38.1		0	0	0	3	4	8	3	0	1	3	3	0	25	30.4878
2		A25	6/4/90	38.1		0	0	4	12	18	8	5	3	1	0	0	0	51	62.19512
2		A26	6/4/90	38.1		0	0	0	5	8	7	14	3	1	2	0	0	40	48.78049
		TOTAL				1	3	21	155	182	145	103	37	23	17	11	3	701	854.878
		% total				0.142653	0.42796	2.99572	22.11127	25.96291	20.68474	14.6933	5.278174	3.281027	2.425107	1.569187	0.42796	100	
		Density	drops/sq ft			1.219512	3.658537	25.60976	189.0244	221.9512	176.8293	125.6098	45.12195	28.04878	20.73171	13.41463	3.658537		854.878
3		A01	6/18/90	38.1		0	0	0	3	8	3	3	1	2	3	0	1	24	26.66667
3		A02	6/18/90	38.1		0	0	1	11	12	11	9	3	0	0	1	0	48	53.33333
3		A04	6/18/90	38.1		0	0	0	9	27	6	1	1	1	2	0	0	47	52.22222
3		A05	LOST																
3		A06	6/18/90	38.1		0	0	1	15	21	12	16	5	1		3	0	75	83.33333
3		A07	6/18/90	38.1		0	0	2	34	32	14	2	9	2	2	1	1	99	110
3		A08	6/18/90	38.1		0	1	1	0	10	8	5	2	1	3	0	0	31	34.44444
3		A09	6/18/90	38.1		0	0	1	3	3	8	6	2	1	0	1	0	25	27.77778
3		A10	6/18/90	38.1		0	1	1	34	13	7	5	0	0	1	0	0	62	68.88889
3		A11	6/18/90	38.1		0	1	3	11	19	15	8	6	4	1	0	0	68	75.55556
3		A12	6/18/90	38.1		0	0	0	7	7	5	0	0	0	0	0	0	19	21.11111
3		A13	6/18/90	38.1		0	0	3	22	16	1	0	0	1	1	0	0	44	48.88889
3		A14	6/18/90	38.1		0	0	2	20	16	3	6	1	0	0	0	0	48	53.33333
3		A15	6/18/90	38.1		0	0	0	5	19	3	5	0	0	0	0	0	32	35.55556
3		A17	6/18/90	38.1		0	0	1	13	12	9	5	1	0	5	1	0	47	52.22222
3		A18	6/18/90	38.1	FLAGGED	0	0	4	19	18	6	0	0	0	0	0	0	47	52.22222
3		A19	6/18/90	38.1		0	0	1	21	13	4	3	0	1	0	0	0	43	47.77778
3		A20	6/18/90	38.1		0	0	4	11	10	7	3	0	1	3	3	0	42	46.66667
3		A21	6/18/90	38.1		0	0	2	8	9	10	14	2	2	0	1	0	48	53.33333
3		A24	6/18/90	38.1		0	0	1	9	13	13	3	3	1	1	0	0	44	48.88889
3		A25	6/18/90	38.1		0	0	0	11	7	3	4	1	0	1	3	0	30	33.33333

Mexican fruit fly droplet size distribution measurements

Droplet Diameter

MEXDROP.XLS

Spray No	Site	Date	Area, sq cm	46-60	60-80	80-108	108-147	147-202	202-279	279-387	387-538	538-747	747-1034	1034-1422	1422+	Drops Counted	Drops/ sq ft
3	A26	6/18/90	38.1	0	0	2	17	14	14	1	1	0	0	0	0	49	54.44444
3	A27	6/18/90	38.1	0	0	0	10	14	4	5	1	0	4	0	0	38	42.22222
	TOTAL			0	3	30	293	313	166	104	39	18	28	14	2	1010	1122.222
	% total			0	0.29703	2.970297	29.0099	30.9901	16.43564	10.29703	3.861386	1.782178	2.772277	1.386139	0.19802	100	
	Density	drops/sq ft			3.333333	33.33333	325.5556	347.7778	184.4444	115.5556	43.33333	20	31.11111	15.55556	2.222222		1122.222

Mexican fruit fly air monitoring -Application 1

site	sequence	cu meters	malathion ug/samp	malaox ug/samp	malathion ug/cu m	malaox ugcum
Indoor	Backgrd					
1	B	720	0.05	0.05	6.94E-05	6.94E-05
6	B	725	0.05	0.05	6.9E-05	6.9E-05
11	B	720	0.05	0.05	6.94E-05	6.94E-05
19	B	720	2.67	2.33	0.003708	0.003236
		avg	0.705	0.62	0.000979	0.000861
		stdev	1.31	1.14	0.00182	0.001583
		sterr	0.378165	0.32909	0.000525	0.000457
		max	2.67	2.33	0.003708	0.003236
		min	0.05	0.05	6.9E-05	6.9E-05
Indoor	Spray					
1	S	134	0.05	0.05	0.000373	0.000373
6	S	130	0.2	0.05	0.001538	0.000385
11	S	135	0.26	0.05	0.001926	0.00037
19	S	133	1.31	0.05	0.00985	0.000378
		avg	0.455	0.05	0.003422	0.000378
		stdev	0.576802	0	0.004336	6.17E-06
		sterr	0.166508	0	0.001252	1.78E-06
		max	1.31	0.05	0.00985	0.000385
		min	0.05	0.05	0.000373	0.00037
Indoor	1st Post					
1	P	1444	0.05	0.05	3.46E-05	3.46E-05
6	P	1440	1.53	0.11	0.001063	7.64E-05
11	P	1440	20.47	8.82	0.014215	0.006125
19	P	1465	52.63	32.69	0.035925	0.022314
		avg	18.67	10.4175	0.012809	0.007138
		stdev	24.47451	15.40937	0.016708	0.010514
		sterr	7.065187	4.448303	0.004823	0.003035
		max	52.63	32.69	0.035925	0.022314
		min	0.05	0.05	3.46E-05	3.46E-05
Indoor	2nd Post					
6	F	1440	0.98	0.05	0.000681	3.47E-05
19	F	1440	14.38	16.17	0.009986	0.011229
1	F	1435	0.05	0.05	3.48E-05	3.48E-05
11	F	1435	18.04	9.78	0.012571	0.006815
		avg	8.3625	6.5125	0.005818	0.004529
		stdev	9.191722	7.905097	0.006398	0.005493
		sterr	2.653423	2.282006	0.001847	0.001586

Mexican fruit fly air monitoring -Application 1

site	sequence	cu meters	malathion	malaox	malathion	malaox
			ug/samp	ug/samp	ug/cu m	ugcum
		max	18.04	16.17	0.012571	0.011229
		min	0.05	0.05	3.48E-05	3.47E-05
Outdoor	Backgrd					
1	B	720	0.13	0.15	0.000181	0.000208
6	B	720	1.45	1.26	0.002014	0.00175
11	B	720	0.28	0.25	0.000389	0.000347
19	No Good					
		avg	0.62	0.553333	0.000861	0.000769
		stdev	0.722703	0.61403	0.001004	0.000853
		sterr	0.217904	0.185137	0.000303	0.000257
		max	1.45	1.26	0.002014	0.00175
		min	0.13	0.15	0.000181	0.000208
Outdoor	Spray					
1	S	137	1.04	0.1	0.007591	0.00073
6	S	135	2.63	0.11	0.019481	0.000815
11	S	135	2.19	0.05	0.016222	0.00037
19	S	133	7.34	0.11	0.055188	0.000827
		avg	3.3	0.0925	0.024621	0.000686
		stdev	2.7755	0.028723	0.020987	0.000215
		sterr	0.801218	0.008292	0.006058	6.19E-05
		max	7.34	0.11	0.055188	0.000827
		min	1.04	0.05	0.007591	0.00037
Outdoor	1st Post					
6	P	1440	384.82	45.83	0.267236	0.031826
11	P	1440	85.24	76.28	0.059194	0.052972
19	P	1465	63.14	26.77	0.043099	0.018273
1	No Good					
		avg	177.7333	49.62667	0.123177	0.034357
		stdev	179.6824	24.97241	0.125019	0.017487
		sterr	54.17653	7.529497	0.037695	0.005273
		max	384.82	76.28	0.267236	0.052972
		min	63.14	26.77	0.043099	0.018273
Outdoor	2nd Post					
6	F	1435	112.41	21.82	0.078334	0.015206
11	F	1440	68.01	35.68	0.047229	0.024778
19	F	1435	17.03	10.89	0.011868	0.007589
1	F	1440	11.45	8.54	0.007951	0.005931
		avg	52.225	19.2325	0.036346	0.013376
		stdev	47.51382	12.39815	0.0331	0.008608

Mexican fruit fly air monitoring - Application 1

site	sequence	cu meters	malathion	malaox	malathion	malaox
			ug/samp	ug/samp	ug/cu m	ug cu m
		sterr	13.71606	3.579039	0.009555	0.002485
		max	112.41	35.68	0.078334	0.024778
		min	11.45	8.54	0.007951	0.005931

Mexican fruit fly air monitoring - Application 2

	Site No.	cu m air	malathion ug/samp	malaoxon ug/samp	malathion ug/cu m	malaoxon ug/cu m
Indoor Background						
Indoor Background						
	1	1440	85.58	2.03	0.059431	0.00141
	6	1440	87.88	10.82	0.061028	0.007514
	11	1440	21.66	17.07	0.015042	0.011854
	19	1440	23.67	17.88	0.016438	0.012417
Mean			54.6975	11.95	0.037984	0.008299
Std Dev			37.00896	7.327178	0.025701	0.005088
Std Err			18.50448	3.663589	0.01285	0.002544
Min			21.66	2.03	0.015042	0.00141
Max			87.88	17.88	0.061028	0.012417
Outdoor Background						
Site	1	1440	1.4	10.05	0.000972	0.006979
	6	1440	12.28	21.21	0.008528	0.014729
	11	1440	18.04	31.02	0.012528	0.021542
	19	1440	4.17	16.85	0.002896	0.011701
Mean			8.9725	19.7825	0.006231	0.013738
Std Dev			7.606267	8.787117	0.005282	0.006102
Std Err			3.803133	4.393558	0.002641	0.003051
Min			1.4	10.05	0.000972	0.006979
Max			18.04	31.02	0.012528	0.021542
Indoor Spray						
site	1	194	5.25	0.64	0.027062	0.003299
	6	195	12.28	4.26	0.062974	0.021846
	11	190	90.35	6.87	0.475526	0.036158
	19	195	4.37	0.47	0.02241	0.00241
Mean			28.0625	3.06	0.146993	0.015928
Std Dev			41.67559	3.083321	0.219771	0.016192
Std Err			20.8378	1.54166	0.109885	0.008096
Min			4.37	0.47	0.02241	0.00241
Max			90.35	6.87	0.475526	0.036158
Outdoor Spray						
Site	1	190	18.23	1.42	0.095947	0.007474
	6	200	19.5	10.31	0.0975	0.05155
	11	190	22.22	1.31	0.116947	0.006895
	19	195	18.21	1.69	0.093385	0.008667
Mean			19.54	3.6825	0.100945	0.018646
Std Dev			1.885824	4.421217	0.010802	0.021948
Std Err			0.942912	2.210608	0.005401	0.010974
Min			18.21	1.31	0.093385	0.006895
Max			22.22	10.31	0.116947	0.05155
Indoor 1stPost						
Site	1	1440	20.95	222.21	0.014549	0.154313

Mexican fruit fly air monitoring - Application 2

	Site No.	cu m air	malathion ug/samp	malaoxon ug/samp	malathion ug/cu m	malaoxon ug/cu m
Indoor Background						
	6	1440	67.2	5.8	0.046667	0.004028
	11	1440	302.11	167.43	0.209799	0.116271
	19	1455	21.15	39.89	0.014536	0.027416
Mean			102.8525	108.8325	0.071387	0.075507
Std Dev			134.608	102.7244	0.093508	0.0714
Std Err			67.30402	51.36219	0.046754	0.0357
Min			20.95	5.8	0.014536	0.004028
Max			302.11	222.21	0.209799	0.154313
Outdoor 1st Post						
Site	1	1440	279.12	48.66	0.193833	0.033792
	6	1440	115.93	81.06	0.080507	0.056292
	11	1440	200.78	62.74	0.139431	0.043569
	19	1455	107	44.52	0.07354	0.030598
Mean			175.7075	59.245	0.121828	0.041063
Std Dev			80.86377	16.50229	0.056373	0.011555
Std Err			40.43188	8.251147	0.028187	0.005778
Min			107	44.52	0.07354	0.030598
Max			279.12	81.06	0.193833	0.056292
Indoor 2nd Post						
Site	1	1450	12.97	3.64	0.008945	0.00251
	6	1440	138.57	13.85	0.096229	0.009618
	11	1455	33.94	13.5	0.023326	0.009278
	19	770	8.87	25	0.011519	0.032468
Mean			48.5875	13.9975	0.035005	0.013469
Std Dev			60.98493	8.729301	0.041294	0.013082
Std Err			30.49247	4.36465	0.020647	0.006541
Min			8.87	3.64	0.008945	0.00251
Max			138.57	25	0.096229	0.032468
Outdoor 2nd Post						
Site	1	1450	298.31	142.16	0.205731	0.098041
	6	1440	24.83	40.34	0.017243	0.028014
	11	1455	99.71	52.57	0.068529	0.036131
	19	1440	118.67	97.94	0.08241	0.068014
Mean			135.38	83.2525	0.093478	0.05755
Std Dev			115.9297	46.43531	0.079911	0.032043
Std Err			57.96483	23.21766	0.039956	0.016021
Min			24.83	40.34	0.017243	0.028014
Max			298.31	142.16	0.205731	0.098041

Mexican fruit fly air monitoring - Application 3

	Site		cu meters	malathion ug/samp	malaoxon ug/samp	malathion ug/cu m	malaoxon ug/cu m
Indoor	Backgrd						
		1	1440	8.5	173.2	0.005903	0.120278
		6	1440	3.55	8.03	0.002465	0.005576
		11	1440	9.62	11.05	0.006681	0.007674
		19	1440	1.19	2.94	0.000826	0.002042
Mean				5.715	48.805	0.003969	0.033892
Std Dev				4.006998	82.9975	0.002783	0.057637
Std Err				2.003499	41.49875	0.001391	0.028819
Min				1.19	2.94	0.000826	0.002042
Max				9.62	173.2	0.006681	0.120278
Outdoor	Backgrd						
		1	1440	0.13	0.4	9.03E-05	0.000278
		6	1440	3.28	1.82	0.002278	0.001264
		11	1440	2.01	5.96	0.001396	0.004139
		19	1440	1.55	4.85	0.001076	0.003368
Mean				1.7425	3.2575	0.00121	0.002262
Std Dev				1.300343	2.586586	0.000903	0.001796
Std Err				0.650171	1.293293	0.000452	0.000898
Min				0.13	0.4	9.03E-05	0.000278
Max				3.28	5.96	0.002278	0.004139
Indoor	Spray						
		1	165	1.17	19.09	0.007091	0.115697
		6	130	0.79	1.97	0.006077	0.015154
		11	128	2.67	2.17	0.020859	0.016953
		19	129	1.97	1.46	0.015271	0.011318
Mean				1.65	6.1725	0.012325	0.03978
Std Dev				0.839206	8.616853	0.007023	0.050666
Std Err				0.419603	4.308427	0.003511	0.025333
Min				0.79	1.46	0.006077	0.011318
Max				2.67	19.09	0.020859	0.115697
Outdoor	Spray						
		1	165	11.21	1.3	0.067939	0.007879
		6	135	16.97	1.91	0.125704	0.014148
		11	128	11.65	1.46	0.091016	0.011406
		19 No Good					
Mean				13.27667	1.556667	0.094886	0.011144
Std Dev				3.206078	0.31628	0.029076	0.003143
Std Err				1.851084	0.15814	0.016788	0.001815
Min				11.21	1.3	0.067939	0.007879
Max				16.97	1.91	0.125704	0.014148
Indoor	1st Post						
		1	1440	30.5	250.88	0.021181	0.174222
		6	1440	19.5	11.08	0.013542	0.007694

Mexican fruit fly air monitoring - Application 3

	Site	cu meters	malathion ug/samp	malaoxon ug/samp	malathion ug/cu m	malaoxon ug/cu m
	11	1440	27.88	30.51	0.019361	0.021188
	19	1440	42.36	106.87	0.029417	0.074215
Mean			30.06	99.835	0.020875	0.06933
Std Dev			9.447215	108.8539	0.006561	0.075593
Std Err			4.723607	54.42693	0.00328	0.037796
Min			19.5	11.08	0.013542	0.007694
Max			42.36	250.88	0.029417	0.174222
Outdoor	1st Post					
	1	1440	221.92	117.03	0.154111	0.081271
	6	1440	430.86	312.63	0.299208	0.217104
	11	1440	205.58	98.11	0.142764	0.068132
	19	1455	257.12	73.97	0.176715	0.050838
Mean			278.87	150.435	0.1932	0.104336
Std Dev			103.5837	109.5566	0.072068	0.076205
Std Err			51.79185	54.77828	0.036034	0.038102
Min			205.58	73.97	0.142764	0.050838
Max			430.86	312.63	0.299208	0.217104
Indoor	2nd Post					
	1	1440	36.33	388.72	0.025229	0.269944
	6	1440	19.17	11.23	0.013313	0.007799
	11	1440	39.31	37.46	0.027299	0.026014
	19	1440	26.71	64.54	0.018549	0.044819
Mean			30.38	125.4875	0.021097	0.087144
Std Dev			9.206527	176.8328	0.006393	0.122801
Std Err			4.603263	88.41642	0.003197	0.0614
Min			19.17	11.23	0.013313	0.007799
Max			39.31	388.72	0.027299	0.269944
Outdoor	2nd Post					
	1	1440	63.34	66.65	0.043986	0.046285
	6	1440	159.54	50.32	0.110792	0.034944
	11	1440	153.48	84.79	0.106583	0.058882
	19	1440	90.93	82.85	0.063146	0.057535
Mean			116.8225	71.1525	0.081127	0.049411
Std Dev			47.25589	16.09429	0.032817	0.011177
Std Err			23.62794	8.047145	0.016408	0.005588
Min			63.34	50.32	0.043986	0.034944
Max			159.54	84.79	0.110792	0.058882

APPENDIX C

QUALITY CONTROL DATA FOR CHEMICAL ANALYSIS OF WATER, MASS DEPOSITION AND AIR MONITORING SAMPLES

Table 1. Continuing quality control data for the 1990 Mexfly Project.

Study: 97
Analyte: Malathion
MDL: 0.1 ppb
Date of Report: 7/2/90

Matrix Sample Type: Water
Lab: CDFA
Chemist: Jane White

Extraction Set #	Lab Sample #	Results (ppb)	Spike Level (ppb)	Recovery %	$\bar{X}$	SD	CV %
234-38, 257-62, 498-500	3589	4.74	5.0	95			
501-2, 516-19, 3919-20, 3931-35	3616	4.73	5.0	94			
163, 165, 205, 207, 215, 217, 245, 249, 4136	3882	4.41	5.0	88			
161-62, 203-4, 3967-68, 4132-37	3869	4.32	5.0	86			
185-89, 219-20, 227-30	4263	3.58	5.0	72			
457-60	4219	4.46	5.0	89			
173-79, 191-95, 231-2	43	4.09	5.0	82			
				OVERALL:	87	7.8	9.0

Table 2. Continuing quality control data for the 1990 Mexfly Project.

Study: 97
Analyte: Malaoxon
MDL: 0.1 ppb
Date of Report: 7/2/90

Matrix Sample Type: Water
Lab: CDFA
Chemist: Jane White

Extraction Set #	Lab Sample #	Results (ppb)	Spike Level (ppb)	Recovery %	$\bar{X}$	SD	CV (%)
234-38, 257-62, 498-500	3588	4.99	5.0	100			
501-2, 516-19, 3919-20, 3931-35	3615	4.91	5.0	98			
163, 165, 205, 207, 215, 217, 245, 249, 4136	3881	4.5	5.0	90			
161-62, 203-4, 3967-68, 4132-37	3870	5.42	5.0	108			
185-89, 219-20, 227-30	4262	3.77	5.0	75			
457-60	4218	4.74	5.0	95			
173-79, 191-95, 231-2	44	3.97	5.0	79			
				OVERALL:	92	12	13

Table 3. Continuing quality control data for the 1990 Mexfly Project.

Study: 97
Analyte: Malathion
MDL: 1 .O ug/sample
Date of Report: 7/2/90

Sample Type: Kimbie
Lab: CDFA
Chemist: Jane White

Extraction Set #	Lab Sample #	Results (ug)	Spike Level (ug)	Recovery %	$\bar{X}$	SD	c v %
85-92, 12-l 9, 93-1 00	3708	982.57	1000	98			
1303-8, 1337, 1354, 1348, 1385-91	4121	1004.4	1000	100			
81-4, 1293-4, 1344,1355, 1392-94, 3077, 3080	4123	1006.6	1000	101			
4-6, 55-80	4336	893.98	1000	89			
4-6, 55-80	4337	957.22	1060	96			
				OVERALL:	97	4.8	4.8

Table 4. Continuing quality control data for the 1 990 Mexfly Project.

Study: 97
Analyte: Malaoxon
MDL: 1 .0 ug\sample
Date of Report: 7/2/90

Sample Type: Kimble
Lab: CDFA
Chemist: Jane White

Extraction Set #	Lab Sample #	Results (ug)	Splke Level (ug)	Recovery %	$\bar{X}$	SD	c v (%)
85-92, 12-19, 93-100	3709	939.26	1000	94			
1303-8, 1337, 1354, 1348.138591	4120	1005.8	1000	101			
81-4, 1293-4, 1344,1355, 1392-94, 3077, 3080	4122	1011.8	1000	101			
4-6, 55-80	4338	966.99	1000	87			
4-6, 55-80	4339	969.85	1000	97			
				OVERALL:	98	3.0	3.1

Table 5. Continuing quality control data for the 1990 Mexfly Project.

Study: 97
Analyte: Malathion
MDL: 0.1 ug/sample
Date of Report: 7/2/90

Sample Type: XAD-2 Resin
Lab: CDFA
Chemist: Jane White

Extraction Set #	Lab Sample #	Results (ug)	Spike Level (ug)	Recovery %	$\bar{X}$	SD	C V %
270, 272-3, 300-2, 308-10, 360, 363, 374, 384-7	3832	4.37	5	87			
256, 261, 271, 276-9, 303, 306, 354-7, 372-5, 385	3835	4.37	5	87			
282-91, 330-1, 336-9, 342-9, 366-8	69	4.42	5	88			
285, 292-3, 332-3, 338, 343-51, 368-9, 379	72	4.42	5	88			
274-5, 280-1, 346, 381-2, 390-1, 396-7, 402-3, 408-10	4257	5.33	5	107			
309-I 1, 345, 364-5, 380, 383, 392-3, 398-9, 404-5, 41 I-I	75	4.48	5	90			
				OVERALL:	91	7.8	8.6

Table 6. Continuing quality control data for the 1990 Mexfly Project.

Study: 97
Analyte: Malaoxon
MDL: 0.1 ug/sample
Date of Report: 7/2/90

Sample Type: XAD-2 Resin
lab: CDFA
Chemist: Jane White

Extraction Set #	Lab Sample #	Results (ug)	Spike Level (ug)	Recovery %	$\bar{X}$	SD	C V (%)
270, 272-3, 300-2, 308-10, 360, 363, 374, 384-7	3831	4.09	5	82			
256, 261, 271, 276-9, 303, 306, 354-7, 372-5, 385	3834	5.33	5	107			
282-91, 330-1, 3369, 342-9, 366-8	70	4.45	5	89			
285, 292-3, 332-3, 338, 343-51, 368-9, 379	73	4.24	5	85			
274-5, 280-1, 346, 381-2, 390-1, 396-7, 402-3, 408-10	4256	5.50	5	110			
309-I 1, 345, 364-5, 380, 383, 392-3, 398-9, 404-5, 41 I-I	76	3.54	5	71			
				OVERALL:	91	15	17